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α 2 Simple Application Controller

HARDWARE MANUAL

HARDWARE-HANDBUCH

MANUEL DU MATÉRIEL

MANUALE HARDWARE

MANUAL DE HARDWARE

MASKINVARUHANDBOK

РУКОВОДСТВО ПО АППАРАТНОЙ ЧАСТИ

Foreword

- This manual contains text, diagrams and explanations which will guide the reader in the correct programming and operation of the α/α 2 series controller.
- Before attempting to install or use the α/α 2 Series Controller this manual should be read and understood.
- If in doubt at any stage of the installation of the α/α 2 Series Controller always consult a professional electrical engineer who is qualified and trained to local and national standards which apply to the installation site.
- If in doubt about the operation or use of the α/α 2 Series Controller please consult the nearest Mitsubishi Electric distributor.
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α2 Simple Application Controller

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Hardware Manual

Manual number: JY992D97301

Manual revision: H

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FAX BACK

Mitsubishi has a world wide reputation for its efforts in continually developing and pushing back the frontiers of industrial automation. What is sometimes overlooked by the user is the care and attention to detail that is taken with the documentation. However, to continue this process of improvement, the comments of the Mitsubishi users are always welcomed. This page has been designed for you, the reader, to fill in your comments and fax them back to us. We look forward to hearing from you.

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Guidelines for the Safety of the User and Protection of equipment

This manual provides information for the use of the α2 Series Controllers. The manual has been written to be used by trained and competent personnel. The definition of such a person or persons is as follows;

- a) Any engineer who is responsible for the planning, design and construction of automatic equipment using the product associated with this manual should be of a competent nature, trained and qualified to the local and national standards required to fulfill that role. These engineers should be fully aware of all aspects of safety with regards to automated equipment.
- b) Any commissioning or service engineer must be of a competent nature, trained and qualified to the local and national standards required to fulfill that job. These engineers should also be trained in the use and maintenance of the completed product. This includes being completely familiar with all associated documentation for the said product. All maintenance should be carried out in accordance with established safety practices.
- c) All operators of the completed equipment (See Note) should be trained to use that product in a safe manner in compliance to established safety practices. The operators should also be familiar with documentation which is connected with the actual operation of the completed equipment.

Note : The term 'completed equipment' refers to a third party constructed device which contains or uses the product associated with this manual.

Notes on the Symbols Used in this Manual

At various times through out this manual certain symbols will be used to highlight points of information which are intended to ensure the users personal safety and protect the integrity of equipment. Whenever any of the following symbols are encountered its associated note must be read and understood. Each of the symbols used will now be listed with a brief description of its meaning.

Hardware Warnings



- 1) Indicates that the identified danger **WILL** cause physical and property damage.



- 2) Indicates that the identified danger could **POSSIBLY** cause physical and property damage.



- 3) Indicates a point of further interest or further explanation.

Software Warnings



- 4) Indicates special care must be taken when using this element of software.



- 5) Indicates a special point which the user of the associate software element should be aware of.



- 6) Indicates a point of interest or further explanation.

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- All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- Please contact a Mitsubishi Electric distributor for more information concerning applications in life critical situations or high reliability.

Further Information Manual Lists

	Manual Name	Manual No.	Description
⊙	α2 Hardware Manual (This manual)	JY992D97301	This manual contains hardware explanations for wiring, installation and specification for the α2 Series controllers.
⊙	α2 Programming Manual <English only>	JY992D97101	This manual contains instruction explanations for the α2 Series controllers.
○	α Software Manual <English only>	JY992D74001	This manual contains explanations of operation of AL-PCS/WIN-E Programming Software.
○	α2 Series Communication User's Manual <English only>	JY992D97701	This manual contains explanations for the setup, messaging, diagnostics, bit assignments, etc for communications using the α2 series controller.
□	α2 Series Installation Manual	JY992D97501	This manual contains installation explanations for the α2 Series controller.
□	AL2-4EX, AL2-4EX-A2, AL2-4EYR, AL2-4EYT Installation Manual	JY992D97401	This manual contains installation explanations for the AL2-4EX, AL2-4EX-A2, AL2-4EYR and AL2-4EYT extension module.
□	AL2-EEPROM-2 Hardware Manual	JY992D96801	This manual contains hardware explanations for the AL2-EEPROM-2.
□	AL2-2DA Installation Manual	JY997D09301	This manual contains installation explanations for the AL2-2DA.
□	AL2-2PT-ADP Installation Manual	JY997D09401	This manual contains installation explanations for the AL2-2PT-ADP.
□	AL2-2TC-ADP Installation Manual	JY997D09501	This manual contains installation explanations for the AL2-2TC-ADP.
□	AL-232CAB Hardware Manual	JY992D76001	This manual contains hardware explanations for the AL-232CAB.
□	AL2-GSM-CAB Hardware Manual	JY992D97201	This manual contains hardware explanations for the AL2-GSM-CAB.
□	AL-ASI-BD, AL2-ASI-BD Hardware Manual	JY992D81401	This manual contains hardware explanations of wiring, installation and specification, etc. for AL-ASI-BD and AL2-ASI-BD.

⊙ Refer to these manuals.

○ Refer to this manual if necessary.

□ Refer to the content of these manuals if necessary though it is included in α2 Hardware Manual.

Abbreviations

The following definitions or abbreviations will be used throughout this manual.

- The AL-PCS/WIN-E software will be referred to as the VLS software or the programming software.
- The α2 Series Simple Application Controller may be referred to as the α2 series, the α2 series controller or the main module.
- Function Blocks may be referred to as FB(s).
- Function Block Diagram may be referred to as FBD.
- Input/Output may be referred to as I/O.
- Personal Computer may be referred to as PC
- Microsoft Windows[®], Windows[®] 95, Windows[®] 98, Windows[®] Me, WindowsNT[®] Workstation 4.0, Windows[®] 2000, Windows[®] XP and Windows Vista[®] may be referred to generically as Windows.

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1. Introduction

The α2 series can be easily used in all places where control is needed for the home, office, or factory. The controller outputs cycle ON/OFF to control electrical equipment per the Function Block program.

The explanation of the instructions and the operation of main unit can be found in α2 Programming Manual. An explanation of the AL-PCS/WIN-E programming software can be found in the α Series Software Manual.

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Applications

The α2 series is designed to be used in automatic applications including those listed below.

- Automation of lights, air-conditioning, or watering systems
- The opening and shutting of gates
- Easy security systems
- Domestic animal and pet food distribution systems
- Control of stockyards and greenhouses

However, the α2 series is not designed to be used in the following applications. Please contact a Mitsubishi distributor for more information.

- Applications where high reliabilities such as nuclear power control, railway facilities, airline facilities, vehicles, combustion equipment, and medical equipment are required.
- Applications in life critical situations.

1.1 Special Features of the α 2 Series System

- 1) Display message and Function Block data
The α 2 series can display the state of operation and the alarm on the LCD display as a message. It can display the following contents by using the display function block. The value of displayed timers and counters can be changed in the RUN mode.
 - Total characters on LCD display: 12 characters \times 4 lines
 - Display Items: Message, value (current or set) of timer and counter, analog values, etc
- 2) The programming in the personal computer is fast and easy
The programming software AL-PCS/WIN-E for Windows can create and save programs. The programming can be done using a pictorial method in which lines are used to connect function blocks on a programming screen.
Direct programming using the α 2 controller front panel keys is also available.
- 3) LCD image send via GSM modem
The α 2 (AL2-14MR-*,AL2-24MR-*) series is able to send the LCD image as an E-mail using a GSM modem. The user can monitor application status by accessing the diagnostic message sent as an E-mail via GSM modem
- 4) Supports computer link using dedicated protocol
The α 2 (AL2-14MR-*,AL2-24MR-*)series supports computer link (dedicated protocol). User-specific application software using computer link can change schedule data, parameters within Function Blocks and provide condition monitoring of the application.
- 5) Enhancement of clock function
The weekly timer and the calendar timer function have many switches that can be set and provide powerful time dependant control capabilities.
- 6) Analog input, 0 - 10V/0 - 500, -50°C - 200°C (PT100), -50°C - 450°C (K-type thermocouple):
The DC input for the α 2 series can accept of 0 - 10V signals with a resolution of 0 - 500.
- 7) Analog output, 0 - 4000/0 - 10V, 0 - 2000/4 - 20mA:
The α 2 series can output voltage and current signals.
- 8) High speed counter, Max. 1kHz
The α 2 series has high speed counters (Max. 2 points) when using AL2-4EX (EI1, EI2).
- 9) High current output capability

Table 1.1: High Current Output Capability

Output Type		Capability
Relay	AL2-10MR-*: O01 - O04 AL2-14MR-*: O01 - O06 AL2-24MR-*: O01 - O04	8A/Common
	AL2-24MR-*: O05 - O09 AL2-4EYR: EO1 - EO4	2A/Point (4A/Common)
Transistor	AL2-4EYT: EO1 - EO4	1A/Point

- 10) Built-in EEPROM
The built in EEPROM eliminates the need for battery backed data.
- 11) Supports 7 languages:
The α 2 series supports 7 languages (English, German, French, Italian, Spanish, Swedish, and Russian^{*1}). The displayed language can be selected in the TOP MENU.

^{*1} V3.00 or later

1.2 Available Models

Table 1.2: Main Units

Model	Power Supply	Input		Output		Dimensions mm (inches)	MASS (Weight) kg (lbs)
		Type	Number	Type	Number		
AL2-10MR-A	100 - 240V AC~	100 - 240V AC~	6	RELAY	4	71.2 x 90 x 52 (2.8 x 3.54 x 2.05)	0.21 (0.47)
AL2-10MR-D	24V DC	24V DC Sink/Source	6	RELAY	4		0.20 (0.44)
AL2-14MR-A	100 - 240V AC~	100 - 240V AC~	8	RELAY	6	124.6 x 90 x 52 (4.91 x 3.54 x 2.05)	0.30 ^{*1} (0.66)
AL2-14MR-D	24V DC	24V DC Sink/Source	8	RELAY	6		
AL2-24MR-A	100 - 240V AC~	100 - 240V AC~	15	RELAY	9		0.35 ^{*1} (0.77)
AL2-24MR-D	24V DC	24V DC Sink/Source	15	RELAY	9		0.30 ^{*1} (0.66)

*1 Without extension modules.

Table 1.3: Extension Modules/Adapters

Model	Input		Output		MASS (Weight) kg (lbs)
	Type	Number	Type	Number	
AL2-4EX-A2	220 - 240V AC~	4	—		0.05 (0.11)
AL2-4EX	24V DC, Sink/ Source	4	—		
AL2-4EYR	—		RELAY	4	
AL2-4EYT	—		TRANSISTOR	4	
AL2-ASI-BD	AS-interface Input	4	AS-interface Output	4	
AL2-2DA ^{*1}	—		Analog ("0 to 10V" or "4 to 20mA")	2	
AL2-2PT-ADP ^{*1}	PT100 Sensor	2	Analog (0 to 10V)	2	
AL2-2TC-ADP ^{*1}	Thermocouple Sensor (K Type)	2	Analog (0 to 10V)	2	

*1 When using AL2-2DA, AL2-2PT-ADP or AL2-2TC-ADP, α2 main module must be V2.00 or later.

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1.3 Dimensions and Each Part Name

Figure 1.1: Each Part Name(AL2-10MR-*)

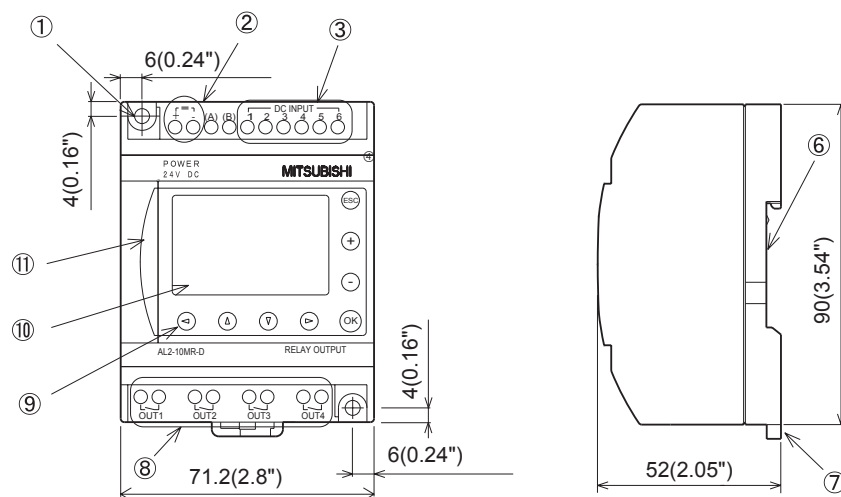


Figure 1.2: Each Part Name(AL2-14MR-*,AL2-24MR-*)

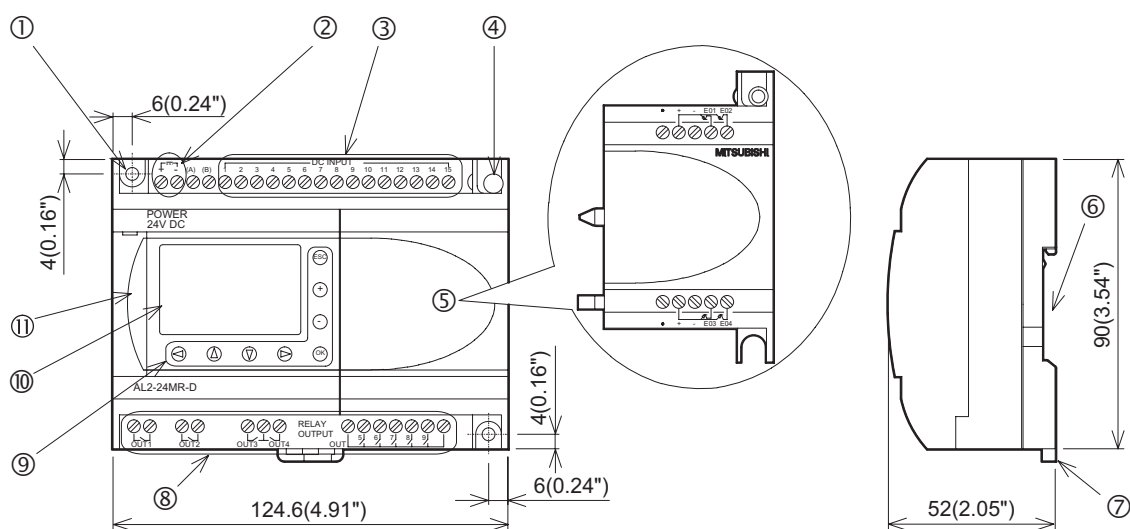


Table 1.4: Each Part Name

Ref.	Item Description
1	Mounting hole, $\phi 4.2$ mm
2	Power terminals
3	Input terminals
4	Mounting screw for the extension cover or extension module
5	Extension cover or extension module(AL2-14MR-*,AL2-24MR-*)
6	Groove for DIN rail mounting (Width of DIN rail 35mm <DIN EN 50022>)
7	DIN-RAIL mounting clips
8	Output terminals
9	Operation keys
10	Liquid crystal display
11	Programming port cover

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Note;

- Refer to chapter 7 about dimensions of the AL-232CAB
- Refer to chapter 8 about dimensions of the AL2-GSM-CAB.
- Refer to chapter 9 about dimensions of the AL2-ASI-BD.
- Refer to chapter 11 about dimensions of the AL2-2DA.
- Refer to chapter 12 about dimensions of the AL2-2PT-ADP.
- Refer to chapter 13 about dimensions of the AL2-2TC-ADP.

1.4 System Configuration

Figure 1.3: System Configuration(AL2-10MR-*)

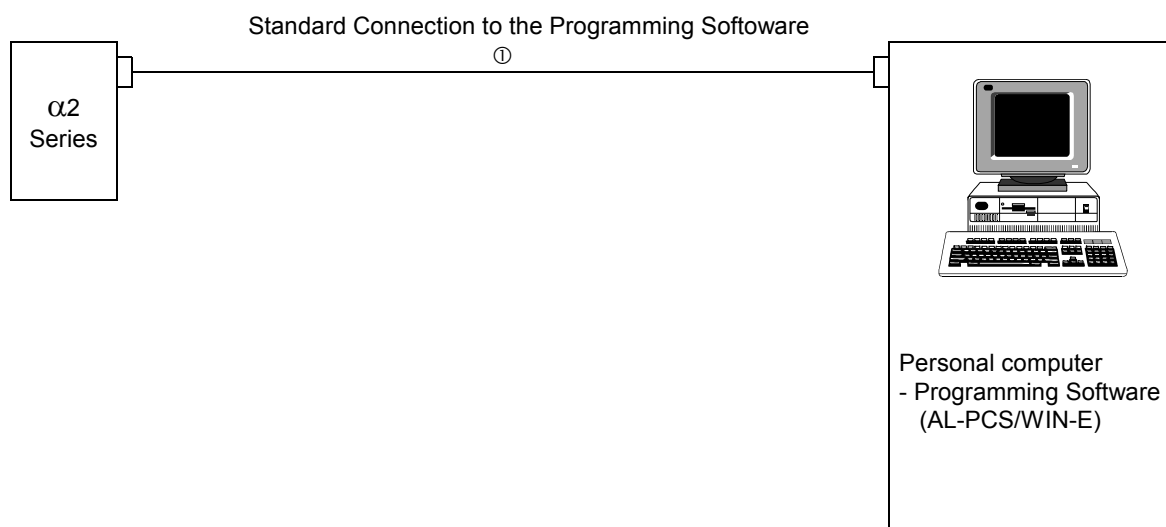


Figure 1.4: System Configuration(AL2-14MR-*,AL2-24MR-*)

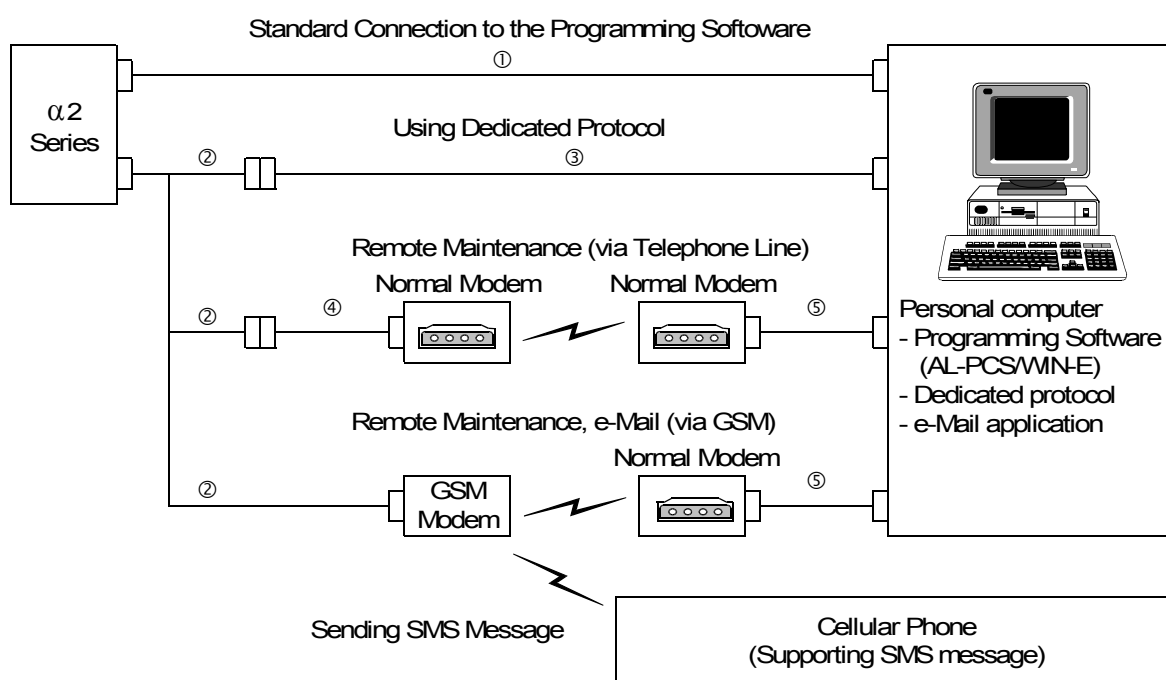


Table 1.5: System Configuration

Item	Using Cable
1	AL-232CAB
2	AL2-GSM-CAB
3	RS-232C cross cable*1
4	RS-232C straight cable for the modem*1
5	RS-232C straight cable for the modem (specified by Modem manufacturer)

*1 Further information can be found in chapter 8.

1.5 Version Up List

Table 1.6: History of α2 Series

Version	Description
V1.00	First product
V2.00	Supports the following points. <ul style="list-style-type: none"> • AL2-2DA, AL2-2PT-ADP, AL2-2TC-ADP modules • New function blocks AO [Analog output] and PID [PID control] • DCF77 Radio clock
V2.20	Supports the following points. <ul style="list-style-type: none"> • New function blocks SMR[Short Message Receiving] and CD[Call Detect] • Enhanced User Program Protection • Enhanced Daylight Saving Time Setup • Enhanced Dedicated Protocol Communication • GSM SIM PIN • Modem Initialization String
V3.00	Supports the following points. <ul style="list-style-type: none"> • Hour Meter backs up by EEPROM (No.197 - 200) • Display Buffer Read by Dedicated Protocol • Russian language addition

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1.6 Applicable Programming Software

Table 1.7: Applicable Programming Software

α2 Version	Programming Software (AL-PCS/WIN-E) Version
V1.00	V2.00 or later
V2.00	V2.30 or later
V2.20	V2.40 or later
V3.00	V2.50 or later



Note;

- AL-PCS/WIN-E versions lower than V2.00, do not communicate with the α2 series.
- AL-PCS/WIN-E versions lower than V2.30, do not use the AL2-2DA, AL2-2PT-ADP or AL2-2TC-ADP.

2. Specifications



Note;

- Refer to chapter 9 about specification of the AL2-ASI-BD.
- Refer to chapter 11 about specification of the AL2-2DA.
- Refer to chapter 12 about specification of the AL2-2PT-ADP.
- Refer to chapter 13 about specification of the AL2-2TC-ADP.

2.1 Power Supply Specification

Table 2.1: Power Supply Specifications

Description	Code	Specification
Power Supply	AL2-***-A	100 - 240V AC~, +10% -15%, 50/60 Hz
	AL2-***-D	24V DC, +20% -15%
Maximum Momentary Power Failure	AL2-***-A	10ms
	AL2-***-D	5ms
In-rush Current	AL2-***-A, 240V AC~ (120V AC~)	≤ 6.5 A (3.5 A) < 5ms
	AL2-***-D, 24V DC	≤ 7.0 A
Maximum Power Consumption	AL2-10MR-A, 264V AC~	4.9 W
	AL2-10MR-D, 28.8V DC	4.0 W
	AL2-14MR-A, 264V AC~	5.5 W
	AL2-14MR-D, 28.8V DC	7.5 W
	AL2-24MR-A, 264V AC~	7.0 W
	AL2-24MR-D, 28.8V DC	9.0 W
Typical Power Consumption (without Special Connection Modules)	AL2-10MR-A, 240V AC~	I/O all On - 3.5 W; I/O all Off - 1.85 W
	AL2-10MR-A, 120V AC~	I/O all On - 3.0 W; I/O all Off - 1.55 W
	AL2-10MR-D, 24V DC	I/O all On - 2.5 W; I/O all Off - 0.75 W
	AL2-14MR-A, 240V AC~	I/O all On - 4.5 W; I/O all Off - 2.0 W
	AL2-14MR-A, 120V AC~	I/O all On - 3.5 W; I/O all Off - 1.5 W
	AL2-14MR-D, 24V DC	I/O all On - 4.0 W; I/O all Off - 1.0 W
	AL2-24MR-A, 240V AC~	I/O all On - 5.5 W; I/O all Off - 2.5 W
	AL2-24MR-A, 120V AC~	I/O all On - 4.5 W; I/O all Off - 2.0 W
	AL2-24MR-D, 24V DC	I/O all On - 5.0 W; I/O all Off - 1.0 W

2.2 Input Specification

Table 2.2: AC Input Specifications

AC Input Specification			
Description	main unit		AL2-4EX-A2
	AL2-10MR-A: I01-I06 AL2-14MR-A, AL2-24MR-A: I01-I08	AL2-24MR-A: I09 - I15	EI1 - EI4
Input Voltage	100 - 240V AC~, +10% -15%, 50/60 Hz		220 - 240V AC~, +10% -15%, 50/60 Hz
Input Current	0.13mA / 120V AC~*1 0.25mA / 240V AC~*1	0.15mA / 120V AC~*1 0.29mA / 240V AC~*1	7.5mA / 240V AC~ 50Hz 9.0mA / 240V AC~ 60Hz
Input Impedance	≥ 800 kΩ		32kΩ (50Hz) 27kΩ (60Hz)
OFF → ON/ ON → OFF	≥ 80V / ≤ 40V		≥ 160V / ≤ 40V
Response Time	OFF → ON	35-85ms, 120V AC~ 25-55ms, 240V AC~	15 - 40ms / 240V AC~
	ON → OFF	35-85ms, 120V AC~ 50-130ms, 240V AC~	
Isolation Circuit	None		Photocoupler
Operation Indication	Liquid Crystal Display		

*1 Current leakage from the sensors connected to the inputs might provide enough current to turn the controller On. Do not use two wire sensors

Table 2.3: DC Input Specifications

Description				Sink ("-" Common)	Source ("+" Common)
Input Voltage				24V DC +20% -15%	24V DC +20% -15%
Input Current	main unit	AL2-10MR-D	I01 - I06	5.5mA, 24V DC	6.0mA, 24V DC
		AL2-14MR-D	I01 - I08		5.5mA, 24V DC
		AL2-24MR-D	I09 - I15		
	AL2-4EX		EI1 - EI4	5.4mA, 24V DC	5.4mA, 24V DC
OFF → ON/ ON → OFF	main unit		I01 - I15	Current: ≥ 4.7mA / ≤ 1.1 mA Voltage: ≤ 4V / ≥ 18V	Voltage: ≥ 18V / ≤ 4V
	AL2-4EX		EI1 - EI4	Voltage: ≥ 18V / ≤ 4V	Voltage: ≥ 18V / ≤ 4V
Response Time	main unit			10 - 20ms	
	AL2-4EX*2			10 - 20ms	
Isolation Circuit	main unit			None	
	AL2-4EX			Photocoupler	
Operation Indication				Liquid Crystal Display	

*2 EI1 and EI2 in AL2-4EX can be used as High Speed Counters.
When using the High Speed Counter function, the input response time is 0.5ms or less.

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Table 2.4: Analog Input Specifications (Only AL2-*-D Type Unit)**

Description	Analog Input Specification
Number of Input Points	6 (I01 - I06) : AL2 - 10MR - D
	8 (I01 - I08) : AL2 - 14MR - D, AL2 - 24MR - D
Analog Input Range	0 - 500
Resolution	9 bit, 20mV (10V/ 500)
Conversion Speed	8ms
Input Voltage	0 - 10V DC
Input Impedance	142kΩ ± 5%
Overall Accuracy	± 5% (0.5V DC)
Offset/Gain	Offset Value = 0 at 0V DC Gain Value: 0 - 10V = 0 - 500 These default values can be changed in the OffsetGain FB
Temperature Drift	± 3 LSB

2.3 Output Specification

Table 2.5: Relay Output Specifications

Description		Relay Specification
Switched Voltage		250V AC~ or less, 30V DC or less
Max. Resistive Load	AL2-10MR-* (O01 - O04)	8A/COM
	AL2-14MR-* (O01 - O06)	
	AL2-24MR-* (O01 - O04)	
	AL2-24MR-* (O05 - O09)	2A/point (4A/COM)
	AL2-4EYR (EO1 - EO4)	2A/point
Contact Life Cycle / Resistance Load	AL2-10MR-* (O01 - O04)	100,000 Cycles at 8 Amps / 240V AC~ or 24V DC
	AL2-14MR-* (O01 - O06)	
	AL2-24MR-* (O01 - O04)	
	AL2-24MR-* (O05 - O09)	100,000 Cycles at 2 Amps / 240V AC~ or 24V DC
	AL2-4EYR (EO1 - EO4)	
Minimum Load		50mW (10mA at 5V DC)
Max. Inductive Load	AL2-10MR-* (O01 - O04)	249 VA (1/3 hp) / 125V AC~, 373 VA (1/2 hp) / 250V AC~
	AL2-14MR-* (O01 - O06)	
	AL2-24MR-* (O01 - O04)	
	AL2-24MR-* (O05 - O09)	93 VA (1/8 hp) / 125V AC~, 93 VA (1/8 hp) / 250V AC~
	AL2-4EYR (EO1 - EO4)	93 VA (1/8 hp) / 250V AC~
Response Time		≤ 10 ms
Operation Indication		Liquid Crystal Display
Isolation Circuit		By Relay

Table 2.6: Transistor Output Specifications (Source Type only) of AL2-4EYT

Description	Transistor Specification
Switched Voltage	5 - 24V DC (+20%, -5%)
Max. Resistive Load	1A / point (8 - 24V DC), 0.1A / point (5 - 8V DC)
Minimum Load	1.0mA
Max. Inductive Load	1A / 24V DC (24 W)
Response Time On/Off, Off/On (approx)	≤ 1 ms
Open Circuit Current Leakage	≤ 0.1mA / 24V DC
Operation Indication	Liquid Crystal Display
Isolation Circuit	Photocoupler

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2.4 General Specification

Table 2.7: Environmental and Electrical Specifications

Description	Specification
Programming Method	Function Block
Program Capacity	200 Function Blocks or 5000 bytes
Program Storage	Built in EEPROM (no battery backup required) or optional EEPROM cassette (AL2-EEPROM-2)
Device Backup	20 Days at 25°C / 77°F (by capacitor)
RTC Backup	20 Days at 25°C / 77°F (by capacitor)
RTC Accuracy	5 s / day (25°C / 77°F)
Operating Temperature	Controller Hardware: (-25) - 55°C / (-13) - 131°F Controller Display: (-10) - 55°C / 14 - 131°F
Storage Temperature	(-30) - 70°C / (-22) - 158°F
Vibration Resistance - Direct Mounting	Conforms to IEC 68-2-6; 10-57Hz: 0.15mm Constant Amplitude 57-150Hz: 19.6m/s ² Acceleration Sweep Count for X,Y,Z: 10 times (80 minutes in each direction)
Vibration Resistance - DIN Rail mounting	Conforms to IEC 68-2-6; 10-57Hz: 0.075mm Constant Amplitude 57-150Hz: 9.8m/s ² Acceleration Sweep Count for X,Y,Z: 10 times (80 minutes in each direction)
Shock Resistance	Conforms to IEC 68-2-27: 147m/s ² Acceleration, Action Time: 11ms 3 times in each direction X,Y, and Z
Noise Immunity	1000Vpp, 1 μs, 30 - 100Hz, tested by noise simulator
Humidity	35 - 85% Relative Humidity, no condensation
Dielectric withstand voltage	3750V AC~ > 1min per IEC 60730-1 between the following points: Power/Input Terminals and Relay Output Terminals Relay Output Terminal and Relay Output Terminal All Terminals and the DIN 43880 Control box or equivalent
Insulation Resistance	7 MΩ at 500V DC per IEC60730-1 between the following points: Power/Input Terminals and Relay Output Terminals Relay Output Terminal and Relay Output Terminal All Terminals and the DIN 43880 Control box or equivalent
Type of Action	IEC 60730-1, Section 6.4.3 - Type 1C (Relay Output)
Type of Action	IEC 60730-1, Section 6.4.3 - Type 1Y (Transistor Output)
Software Class	IEC 60730-1, Section H6.18 - Class A
Purpose of Control	IEC 60730-1, Section 2.2 - Electrical Control
Construction of Control	IEC 60730-1, Section 6.15 - Incorporated Control
Whether the Control is electric	IEC 60730-1, Section H2.5.7 - Electronic Control
Safety Class	II
Pollution Degree	2
Grounding	None
Electrical Isolation	Reinforced primary/secondary insulation
Operation Ambience	To be free of corrosive gases. Dust should be minimal.
Protection	IP 20

Table 2.7: Environmental and Electrical Specifications

Description	Specification
Temperature for the Ball Pressure Test	75°C (167°F)
EC Directive	EMC, LVD
Certifications	UL/cUL
Attestation of Conformity	TÜV PRODUCT SERVICE
Complies with	UL 508 ^{*1} IEC 60730-1 ^{*1} EN 61010-1 EN 50081-1 ^{*1} EN 50082-1 EN 61000-6-2
Liquid Crystal Display	Will display 4 lines of 12 characters per line, Program Run On/Off mode, Password Protection, Image Table, and Function Blocks during programming.

^{*1} AL2-ASI-BD is not complied with these standards.

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3. Installation

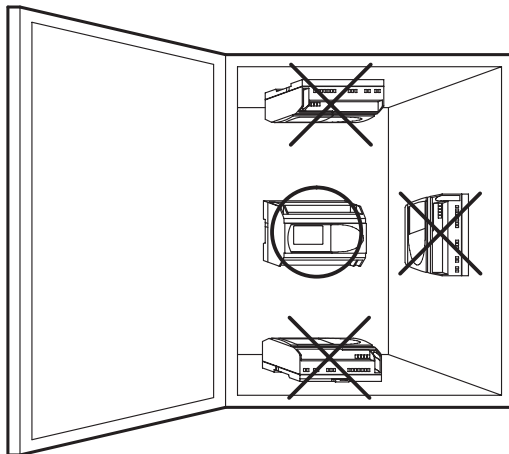
3.1 Installation Mounting Notes



The α 2 Series' safe design means the user can install it almost anywhere but please take the following points into consideration.

- Do not install in areas with excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration. Do not place in water or let water leak onto the controller.
- Do not allow debris to fall inside the unit during installation.
- Keep as far as possible from high-voltage cables and power equipment.
- The α 2 Series Controller must be installed in a distribution box or a control cabinet.

Figure 3.1: Mounting Arrangement.



- Use size M4 screws when mounting by screw holes.
- The connectors must be covered to prevent injury from contact with “live” wires.
- Leave a minimum of 10mm of space for ventilation between the top and bottom edges of the α 2 Series Controller and the enclosure walls.
- Do not disassemble the α 2 Series controller.



Note;

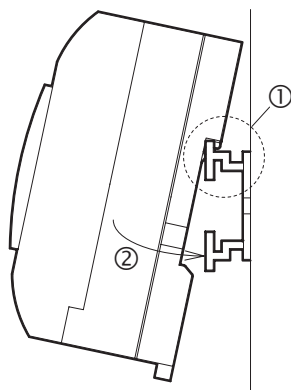
- Refer to chapter 6 when installing or removing the AL2-EEPROM-2.
- Refer to chapter 7 when installing or removing the AL-232CAB.
- Refer to chapter 8 when installing or removing the AL2-GSM-CAB.
- Refer to chapter 9 when installing or removing the AL2-ASI-BD.
- Refer to chapter 11 when installing or removing the AL2-2DA.
- Refer to chapter 12 when installing or removing the AL2-2PT-ADP.
- Refer to chapter 13 when installing or removing the AL2-2TC-ADP.

3.2 DIN RAIL Mounting of Main Unit

Units can be snap mounted to 35mm DIN rail (DIN EN 50022). To release pull the spring loaded clips away from the rail and slide the unit off and up.

3.2.1 Installation

Figure 3.2: Installation

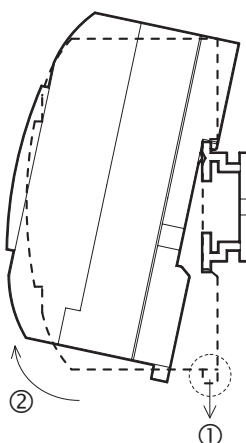


Align the upper side of the α 2 DIN rail mounting groove with the DIN rail (①) and push it onto the rail (②).

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3.2.2 Remove

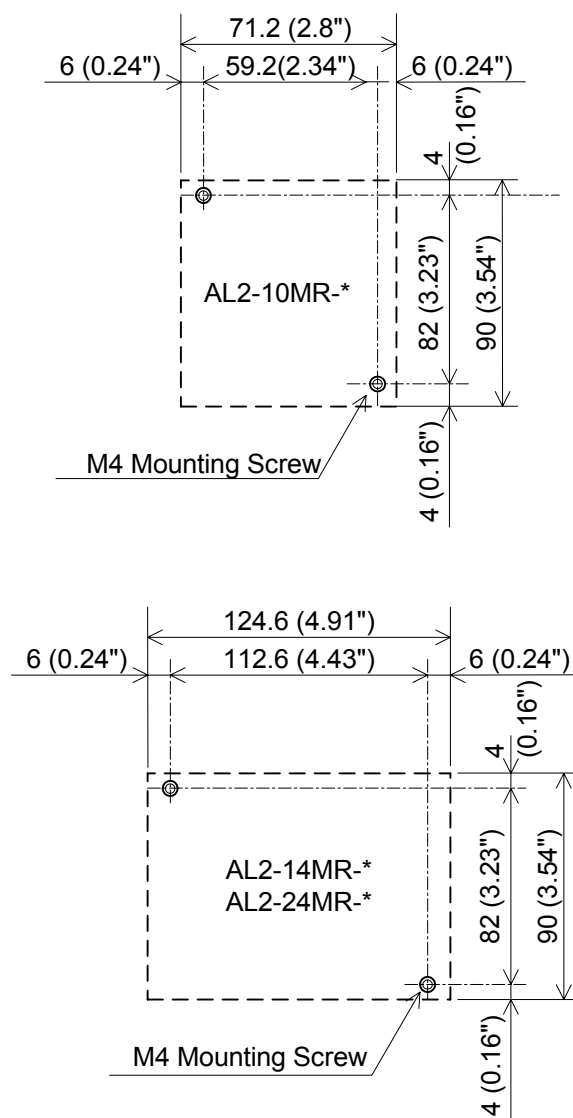
Figure 3.3: Remove



Pull the DIN rail hook (①) and remove the α 2 series main unit(②)

3.3 Direct Mounting of Main Unit

Figure 3.4: Direct Mounting



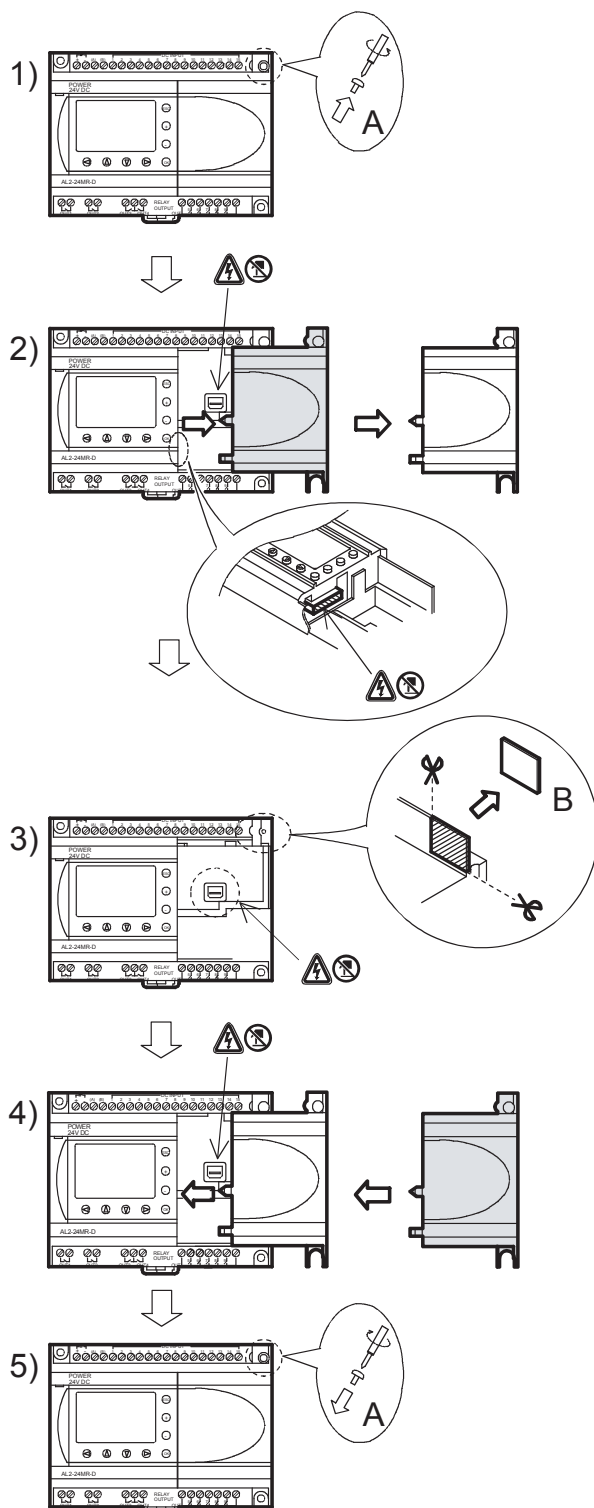
3.4 Install Extension Module(AL2-14MR-*,AL2-24MR-*)



Caution;

Disconnect all terminals from the power supply before removing the cover.

Figure 3.5: Installation



- 1) Release screw 'A' and keep.
- 2) Carefully remove the factory fitted expansion port cover.
- 3) Cut away section 'B' from the α2 series controller main unit.
- 4) Attach the expansion module to the main unit.
- 5) Tighten screw 'A' to a torque of 0.4 N·m.

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4. Wiring



Note;

- Refer to chapter 9 when wiring the AL2-ASI-BD.
- Refer to chapter 11 when wiring the AL2-2DA.
- Refer to chapter 12 when wiring the AL2-2PT-ADP.
- Refer to chapter 13 when wiring the AL2-2TC-ADP.

4.1 Installation Wiring Notes



The wiring of α 2 Series has been designed to be safe and easy. A technician or engineer trained in the local and national electrical standards should perform all tasks associated with the electrical wiring of the α 2 Series controllers. Turn OFF the Power before performing any wiring operations.

- Input and output cables should not be run through the same multicore cable or share the same wire.
- Do not lay input/output cables near high voltage power cables.
- Input and Output cable length must be less than 30m (98' 5").

Allow for voltage drop and noise interference with input/output lines used over an extended distance. Please use wire that is properly sized for the current load.



The terminal will accept a 3 mm flathead screwdriver.

4.2 Wire Size

Wire of the Inputs and Outputs using the following wire. Strip the wire to the following length (See Table 4.1 and Figure 4.1). Please unscrew the terminal to its widest position before inserting a wire. Insert the wire completely into the terminal to ensure that a proper connection can be made.

The terminals will accept a 3mm flathead screwdriver.

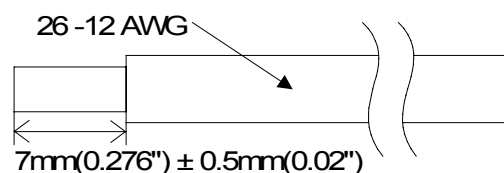
Table 4.1: Wire Size

	Wire Size	Strip Wire Length
Main Unit	26 - 12 AWG (0.13 - 3.31mm ²)	7mm ± 0.5mm
Extension Module	24 - 14AWG (0.2 - 2.5mm ²)	6mm ± 0.5mm

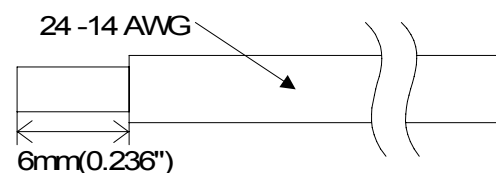
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Figure 4.1: Wire Size

Main unit



Extension module



Note;

- To avoid damaging the wire, tighten to a torque of 0.5 - 0.6 N·m.
- Please do not use tin, solder, or any other substance on the stripped wire that might cause the wire strand to break.
 - Stranded cable:
Remove sheath, twist core wires, then connect cable (or use a crimp terminal).
 - Single cable:
Remove sheath, then connect cable.

4.3 Power Supply



- When wiring AC supplies the “Live” cable should be connected to the “L” terminal and the “Neutral” cable should be connected to the “N” terminal. Do NOT connect the “Live” wire to the “N” terminal, the user might receive a dangerous shock on powerup.
- When wiring DC supplies the “positive” cable should be connected to the “+” terminal and the negative cable should be connected to the “-” terminal. On no account should the power supply terminals be connected to any other terminal on the unit. DC Power Supply units should be capable of providing 4 Amperes of current to the controller.

Figure 4.2: Recommended Power Input Wiring Diagram

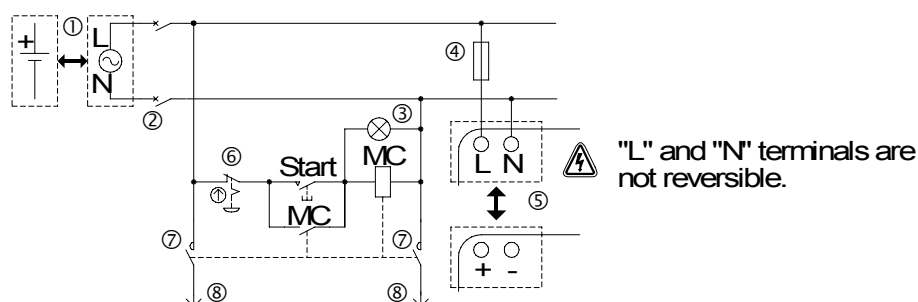


Table 4.2: Recommended Power Wiring

Ref.	Item Description
1	Power supply AL2-***-A: 100-240V AC~, 50/60Hz AL2-***-D: 24V DC
2	Circuit isolation device
3	Power ON pilot indicator
4	Circuit protection device - Limit to 1.0A
5	α2 main unit
6	Emergency stop
7	Magnetic switch contact
8	Power supply for loads

4.4 AC Power Supply and Input Wiring

4.4.1 AC Power Supply and Input Wiring

Figure 4.3: AC Power Supply and Input Wiring Diagram

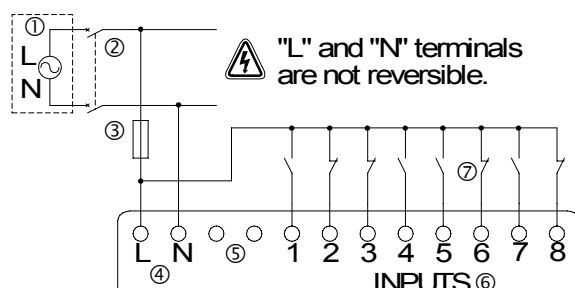


Table 4.3: AC Power Supply and Input Wiring

Ref.	Item Description
1	AC power supply, 100 - 240V AC~, 50/60Hz
2	Circuit isolation device
3	Circuit protection device - Limit to 1.0 Amp
4	AC power terminals
5	Unused terminals
6	Input terminals
7	Digital input switches

4.4.2 AL2-4EX-A2 Input Wiring

Figure 4.4: AL2-4EX-A2 Input Wiring Diagram

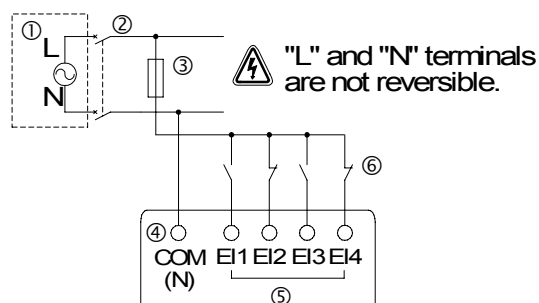


Table 4.4: AC Power Supply and Input Wiring

Ref.	Item Description
1	AC power supply, 220 - 240V AC~, 50 / 60Hz
2	Circuit isolation device
3	Circuit protection device - Limit to 1.0 Amps
4	COM (N) terminal
5	Input terminals
6	Digital input switches

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4.5 DC Power Supply and Input Wiring

4.5.1 DC Power Supply and Source (“+” Common) Input Wiring Diagram

Figure 4.5: DC Power Supply and Source (“+” Common) Input Wiring Diagram

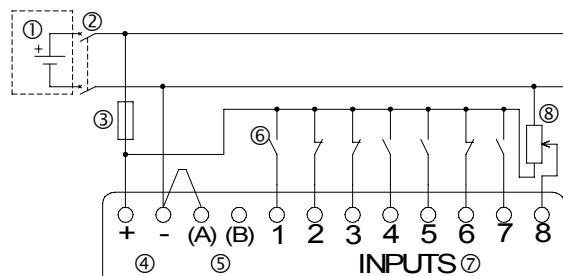


Table 4.5: DC Power Supply and Source (“+” Common) Input Wiring

Ref.	Item Description
1	DC power supply, 24V DC
2	Circuit isolation device
3	Circuit protection device - Limit to 1.0A
4	DC power terminals
5	Sink/Source input wiring terminals
6	Sensor input switches
7	Input terminals
8	Analog input

4.5.2 AL2-4EX Source (“+” Common) Input Wiring Diagram

Figure 4.6: AL2-4EX Source (“+” Common) Input Wiring Diagram

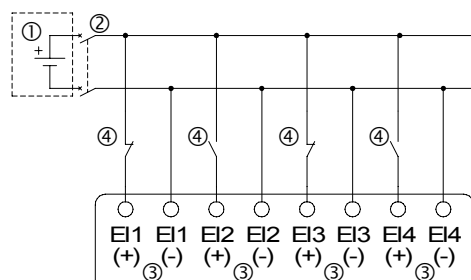


Table 4.6: DC Power Supply and Source (“+” Common) Input Wiring

Ref.	Item Description
1	DC power supply, 24V DC
2	Circuit isolation device
3	Input terminals
4	Sensor input switches



Note:

Each input terminal (EI1 - EI4) can be used as either Source input or Sink input.

4.5.3 DC Power Supply and Sink ("-" Common) Input Wiring Diagram

Figure 4.7: DC Power Supply and Sink ("-" Common) Input Wiring Diagram

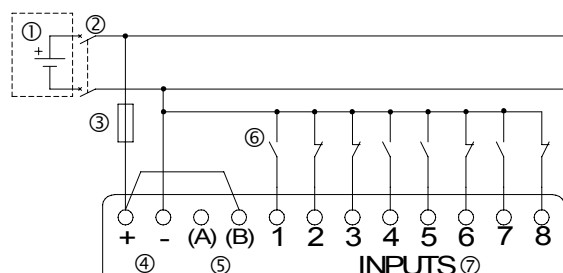


Table 4.7: DC Power Supply and Sink ("-" Common) Input Wiring

Ref.	Item Description
1	DC power supply, 24V DC
2	Circuit isolation device
3	Circuit protection device - Limit to 1.0 Amps
4	DC power terminals
5	Sink/Source input wiring terminals
6	Sensor input switches
7	Input terminals

4.5.4 AL2-4EX Sink ("-" Common) Input Wiring Diagram

Figure 4.8: AL2-4EX Sink ("-" Common) Input Wiring Diagram

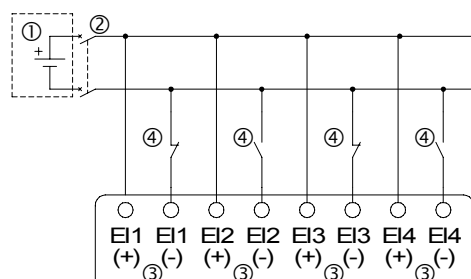


Table 4.8: DC Power Supply and Sink ("-" Common) Input Wiring

Ref.	Item Description
1	DC power supply, 24V DC
2	Circuit isolation device
3	Input terminals
4	Sensor input switches



Note:

Each input terminal (EI1 - EI4) can be used as either Source input or Sink input.

4.6 Output Relay and Transistor Wiring

4.6.1 Relay Output Wiring Diagram main unit (AC and/or DC)

Figure 4.9: Relay Output Wiring Diagram main unit (AC and/or DC)

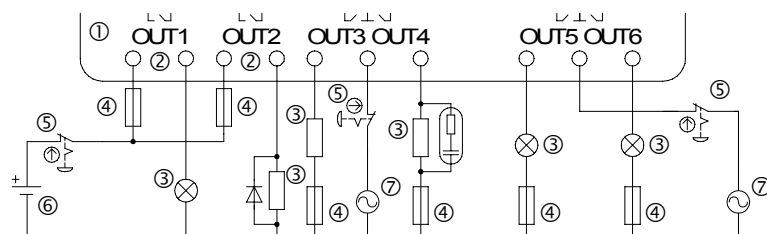


Table 4.9: Relay Output Wiring main unit (AC and/or DC)

Ref.	Item Description
1	α2 main unit
2	Mutually exclusive outputs
3	Output devices
4	Circuit protection device (See Table 4.10)
5	Emergency stop
6	DC power supply
7	AC power supply

Table 4.10: Relay Output Circuit Protection Table

Model	Number of Output	Max. Resistive Load	Circuit Protection (Fuse)
AL2-10MR-*	O01-O04	8A/common	≤ 10A / Circuit
AL2-14MR-*	O01-O06		≤ 10A / Circuit
AL2-24MR-*	O01-O04		≤ 10A / Circuit
	O05-O09	2A/point (4A/common)	≤ 3A / Circuit

4.6.2 Relay Output Wiring Diagram AL2-4EYR (AC and/or DC)

Figure 4.10: Relay Output Wiring Diagram AL2-4EYR (AC and/or DC)

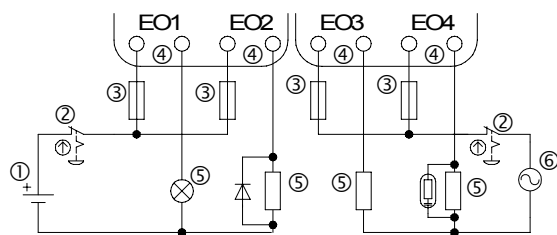


Table 4.11: Relay Output Wiring AL2-4EYR (AC and/or DC)

Ref.	Item Description
1	DC power supply
2	Emergency stop
3	Circuit protection device (Fuse: $\leq 3A$)
4	Mutually exclusive outputs
5	Output devices
6	AC power supply

Table 4.12: Relay Output Circuit Protection Table

Model	Number of Output	Max. Resistive Load	Circuit Protection (Fuse)
AL2-4EYR	EO1-EO4	2A/common	$\leq 3A$ / Circuit

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4.6.3 Transistor Output (Source or “+” Common Only) Wiring Diagram AL2-4EYT

Figure 4.11: Transistor Output (Source/ “+” Common Only) Wiring Diagram AL2-4EYT

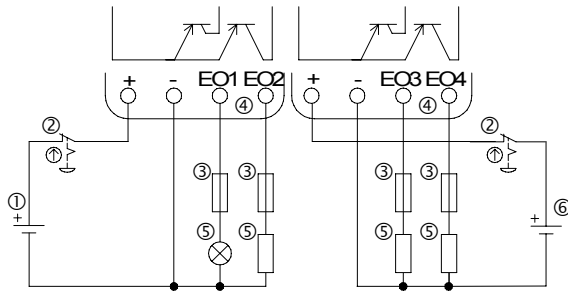


Table 4.13: Transistor Output Wiring

Ref.	Item Description
1	DC Power Supply: 24V DC
2	Emergency Stop
3	Circuit Protection Device - See Table 4.14 for Specifications
4	Power Supply Terminal
5	Output Devices
6	DC Power Supply: 12V DC

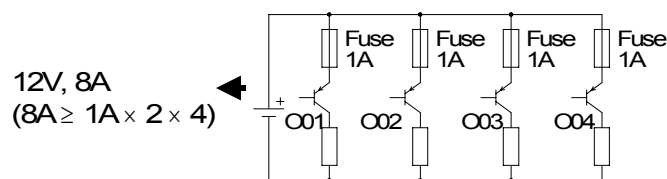
Table 4.14: Transistor Output Circuit Protection Table

Circuit Voltage	Circuit Protection (Fuse)
5V DC	$\leq 0.3\text{A/Circuit}$
12V DC	$\leq 2.0\text{A/Circuit}^{*1}$
24V DC	$\leq 2.0\text{A/Circuit}^{*1}$

*1 Power Source capacity \geq Fuse size \times 2



Figure 4.12: Example Fuse Size Calculation



Note;



Table 4.15: Output Terminal Notes

Volt	Output Terminal Notes
5	Each circuit can contain from one output terminal up to every output terminal.
12-24	Each circuit can contain from one output terminal up to every output terminal.
5,12,24	Using any combination of 5 Volt, 12 Volt, and 24 Volt outputs can be accomplished on the same α2 Series Controller if separate circuits are used for each voltage level.

5. Terminal Layout



Note;

- Refer to chapter 9 about terminal layout of the AL2-ASI-BD.
- Refer to chapter 11 about terminal layout of the AL2-2DA.
- Refer to chapter 12 about terminal layout of the AL2-2PT-ADP.
- Refer to chapter 13 about terminal layout of the AL2-2TC-ADP.

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Figure 5.1: AL2-10MR-A, AC Input, Relay Output

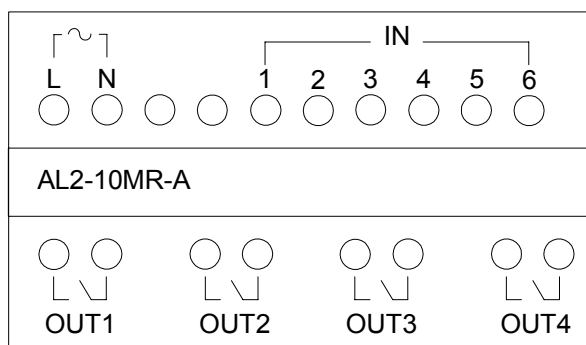


Figure 5.2: AL2-10MR-D, DC Input, Relay Output

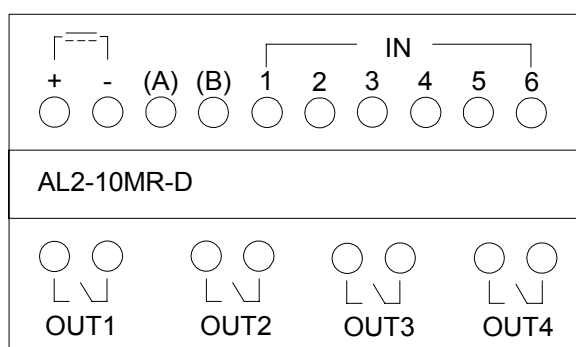


Figure 5.3: AL2-14MR-A, AC Input, Relay Output

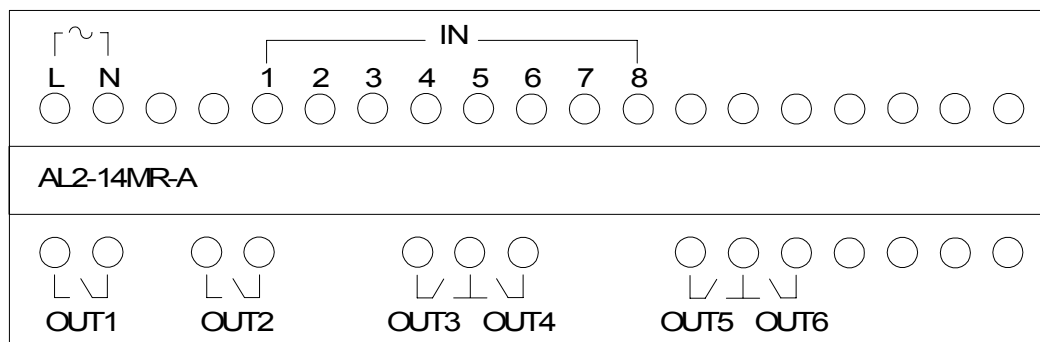


Figure 5.4: AL2-14MR-D, DC Input, Relay Output

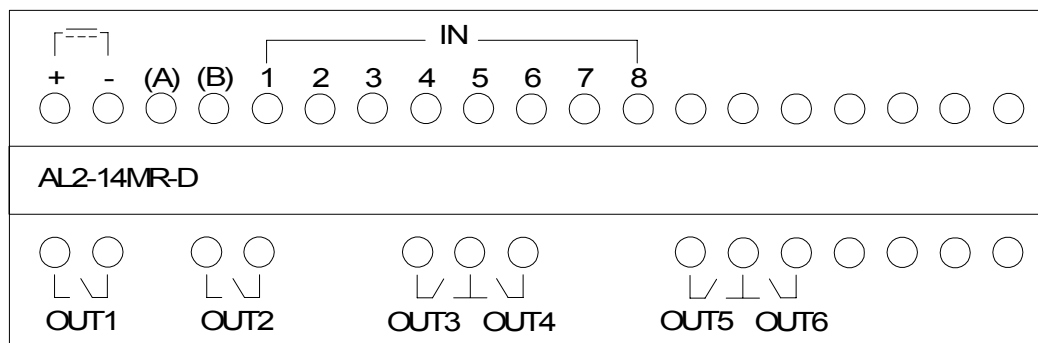


Figure 5.5: AL2-24MR-A, AC Input, Relay Output

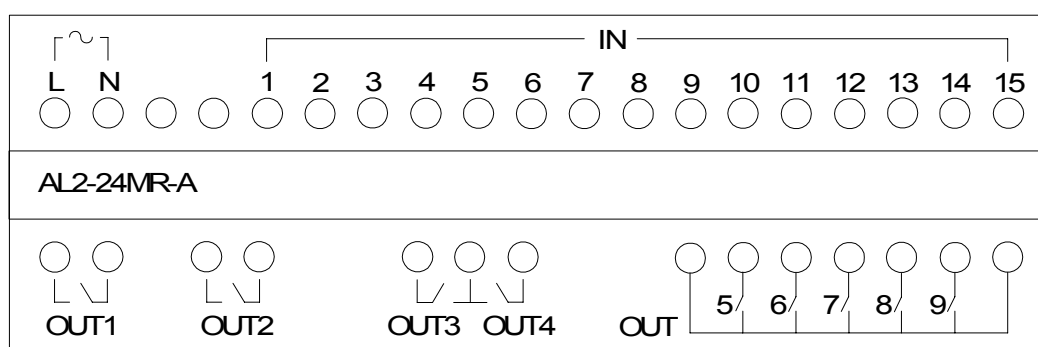


Figure 5.6: AL2-24MR-D, DC Input, Relay Output

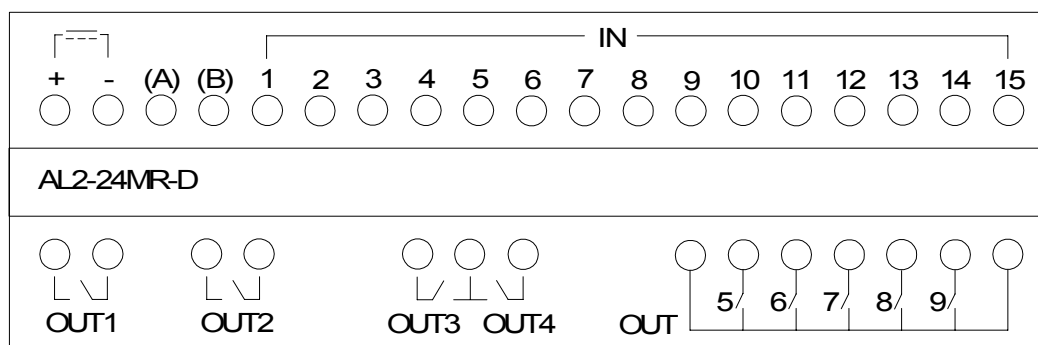


Figure 5.7: AL2-4EX-A2, 220 - 240V AC Input

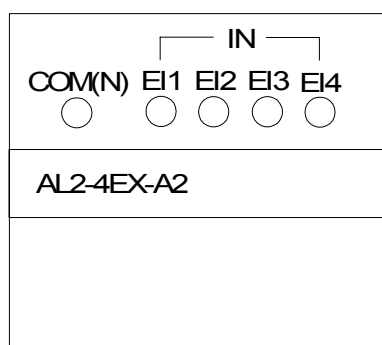


Figure 5.8: AL2-4EX, DC Input

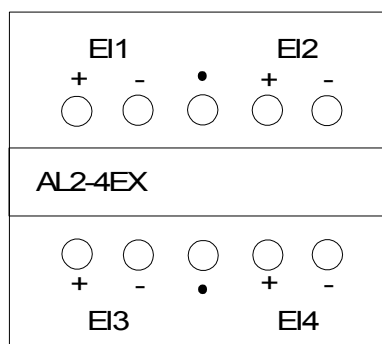


Figure 5.9: AL2-4EYR, Relay Output

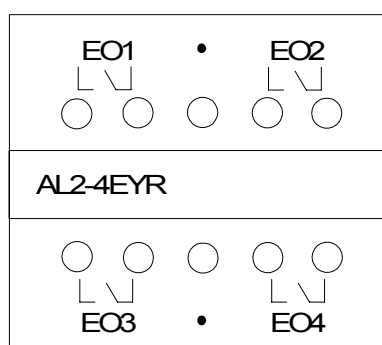
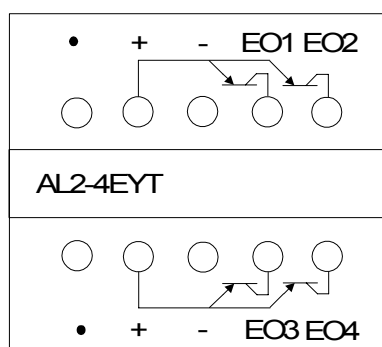


Figure 5.10: AL2-4EYT, Transistor Output



ENG

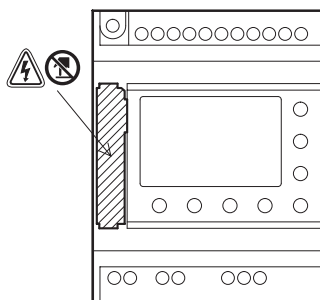
6. AL2-EEPROM-2

The AL2-EEPROM-2 memory cassette is for use only with the α 2 series controller (Model: AL2-**M*-*).



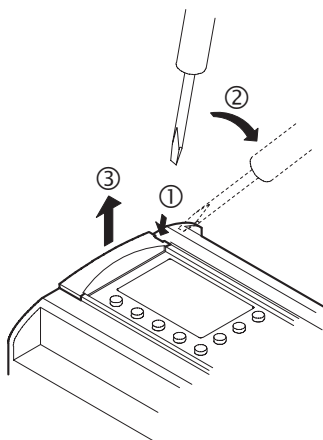
Caution

- Persons trained in the local and national electrical standards must replace the memory cassette.
- Turn off the power supply when installing or removing the memory cassette.
- Replace the cover after removing the memory cassette.
- When installing the connector cover or the memory cassette of α 2 series, be careful not to pinch your finger.
- DO NOT touch the following part when removing the cover or memory cassette.

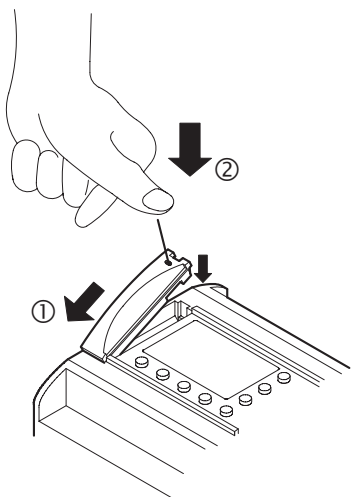


6.1 Installation

- 1) Remove the cover or the memory cassette



- 2) Install on the cover or the memory cassette



ENG

7. AL-232CAB

7.1 Introduction

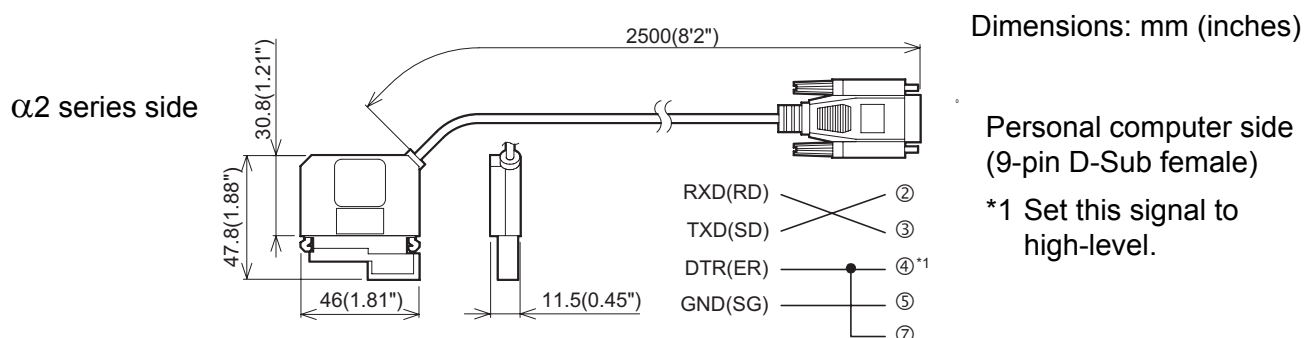
The AL-232CAB is an RS-232C cable used to connect an α series controller (α, α2) and a personal computer that is running the programming software (AL-PCS/WIN-E).



Note;

- AL-232CAB cable cannot be used for any other applications.
- AL-232CAB cable rises about 40mm (1.57") above the top panel when connecting to an α2 series controller.

7.1.1 External Dimensions



7.2 Connected to AL-232CAB cable



Remove cover and memory cassette

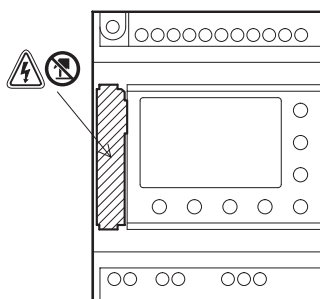
- Be careful of personal safety when removing the α 2 cover.



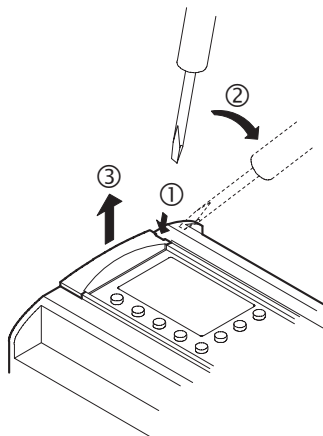
Caution

- Turn off the power supply when you install or detach the AL-232CAB cable.
- Install the cover or the memory cassette after removing the AL-232CAB cable.
- When installing the connector cover or the memory cassette of α 2 series, be careful not to pinch your finger.
- Please hold the protective case when detaching the cable. DO NOT pull on the cord.
- DO NOT touch the following part when removing the cover, memory cassette or this cable.

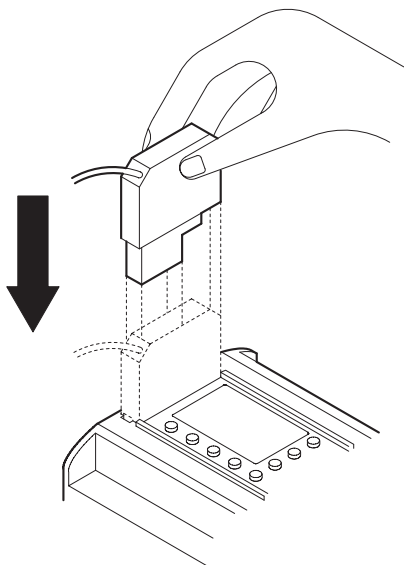
ENG



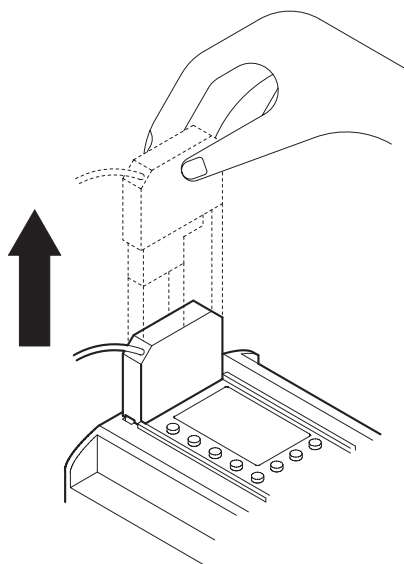
1) Removing the cover or the memory cassette



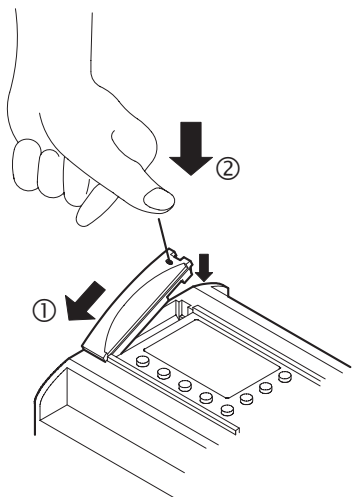
2) Connecting the AL-232CAB cable



3) Removing the AL-232CAB cable



4) Installing on the cover or the memory cassette



MEMO

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8. AL2-GSM-CAB

8.1 Introduction

The AL2-GSM-CAB can be used to connect α2 Series Controllers to a normal or GSM modem. The AL2-GSM-CAB can transfer Short Message Service (SMS) data to a GSM modem for transmission to mobile phones and mail addresses or can facilitate remote monitoring functions and program transfers via normal modems. RS-232C communication to a personal computer can also be accomplished if an adaptor or cable is used.

Further information can be found in the α2 Programming Manual and α Software Manual.



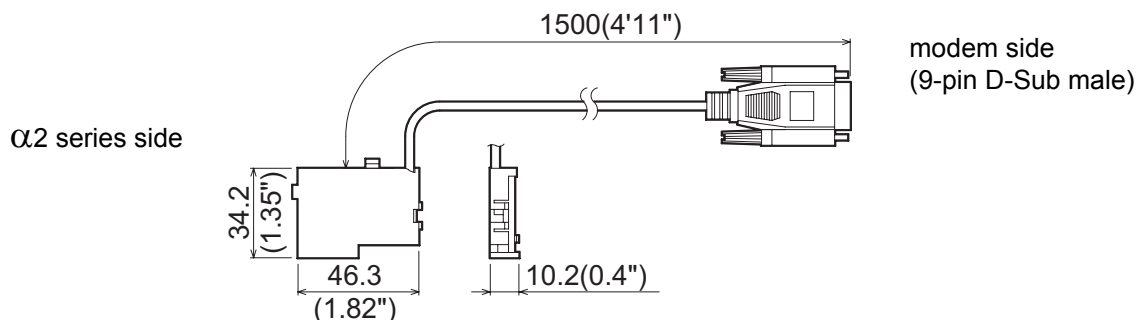
Note;

- This cable cannot be used for any other applications.
- This cable attaches only to the α2 Series Controller (Model: AL2-14MR-*,AL2-24MR-*).
- Simultaneous communication through both ports of the α2 Series Controllers may result in a damaged program or a malfunction in the controller.

8.1.1 External Dimensions

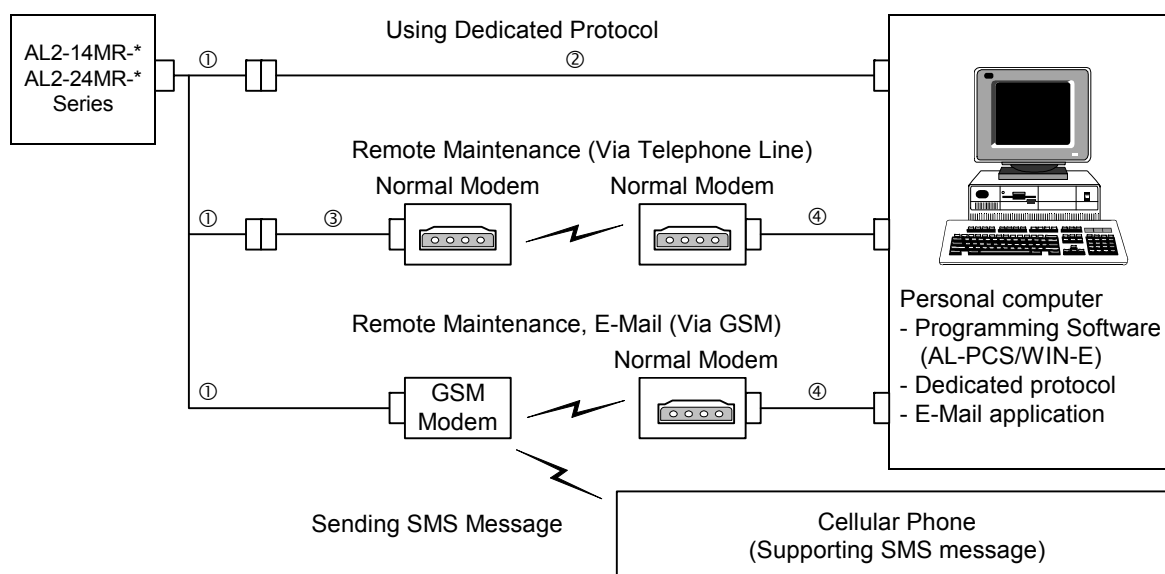
Figure 8.1: External Dimensions

Dimensions: mm (inches)



8.1.2 System Configuration with using AL2-GSM-CAB

Figure 8.2: System Configuration with AL2-GSM-CAB

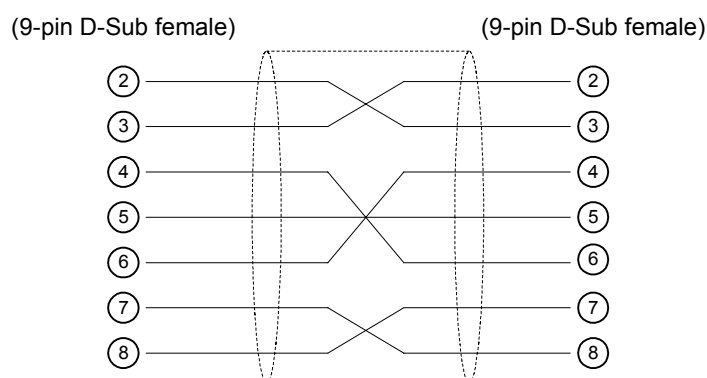


ENG

Table 8.1: System Configuration with AL2-GSM-CAB

Item	Using Cable
1	AL2-GSM-CAB
2	RS-232C cross cable (See Figure 8.3)
3	RS-232C straight cable for the modem (See Figure 8.5)
4	RS-232C straight cable for the modem (specified by modem manufacturer)

Figure 8.3: RS-232C Cross Cable Reference



Note;

The 4 and 7 signals must be set to high-level on the personal computer side. If these signals are not set, it will not communicate to α2 series.

8.2 Installation

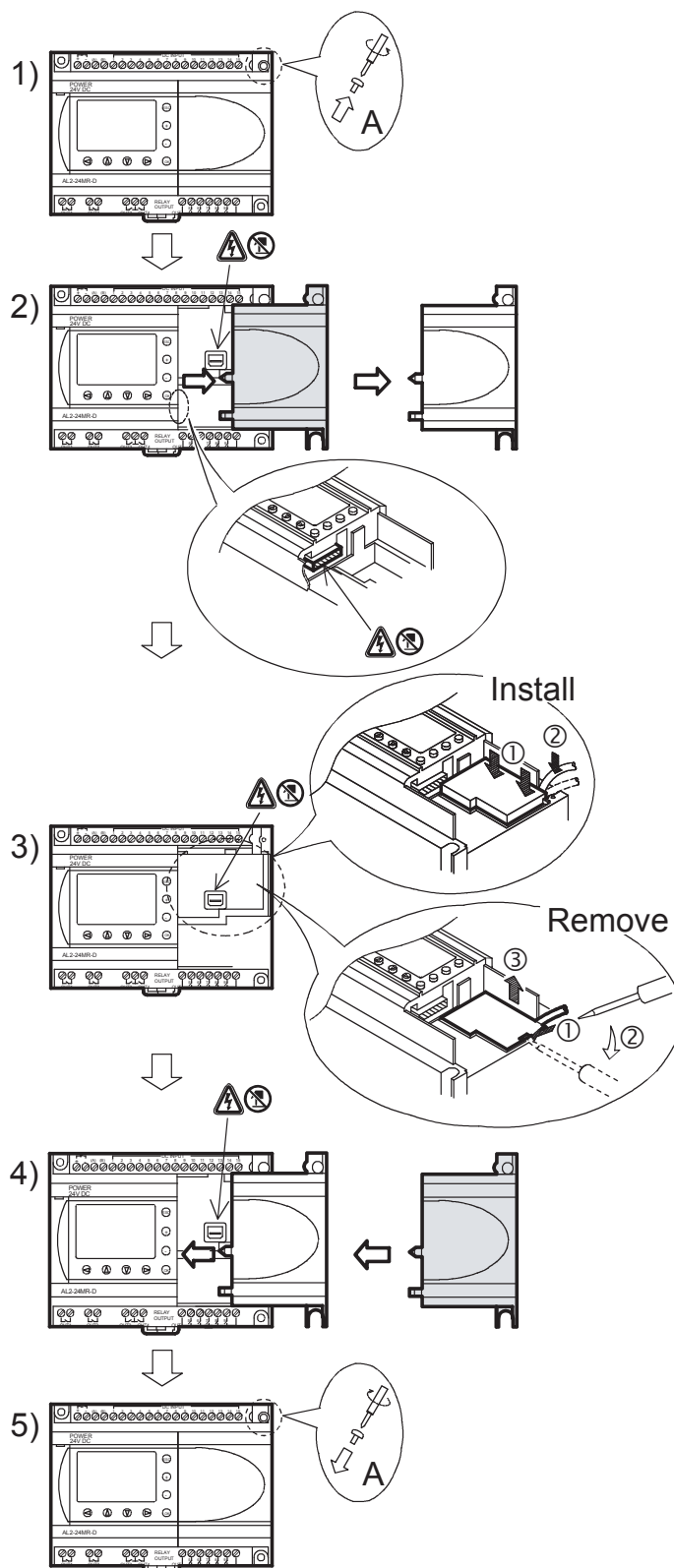
When installing AL2-GSM-CAB refer to Figure 8.4.



Caution

- Persons trained in the local and national electrical standards must install or remove the AL2-GSM-CAB.
- Turn off the power supply when installing or removing the AL2-GSM-CAB.
- Put the cover back on after either installing or removing the AL2-GSM-CAB.
- Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.
- Do not pull on the cord, otherwise the cable may be damaged.
- When communicating to α2 series via GSM modem, the power supply for both units must be turned ON at the same time. If they are not started up at same time, the α2 series will not communicate via GSM modem.
- Disconnect all terminals from the power supply before removing the cover.

Figure 8.4: Installation



- 1) Release screw 'A' and keep.
- 2) Carefully remove the factory fitted α2 expansion port cover or special module cover.
- 3) Install the AL2-GSM-CAB into the cavity, carefully placing the cable in the channel located on the input terminal side.
- 4) Attach the α2 cover or expansion module taking care that there is no interference with the AL2-GSM-CAB.
- 5) Tighten screw 'A' to a torque of 0.4 N·m.

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8.3 Remote Maintenance with a Modem

Further information of the modem setup procedures can be found in the α2 Programming Manual. The programming software (AL-PCS/WIN-E) provides the easiest method to setup the modem.

8.3.1 Recommended Modems

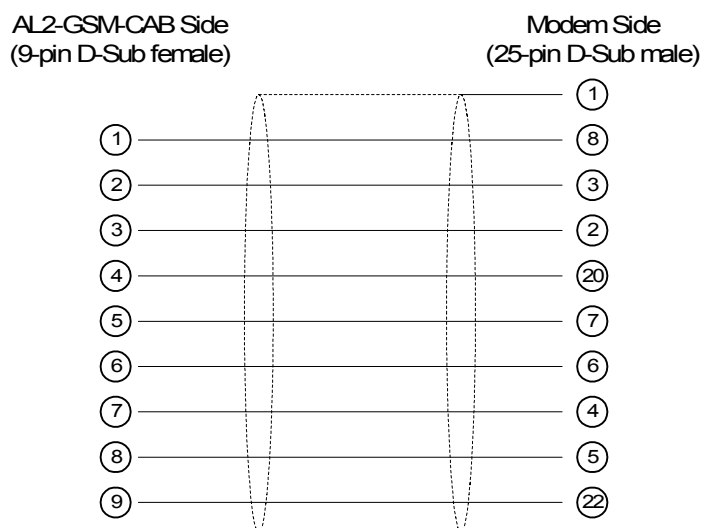
The following modems have been successfully tested.

Table 8.2: Tested Modems

Maker name	Model name	Modem command (AT command)
3com	SP560V-P	ATE0Q1&B1&D0H0&I0&R1&S0S0=2S15=8&W
OMRON	ME3314	ATE0S0=2Q1&D0S15=8&R1&H0&W
AIWA	PV-AF3360	ATE0S0=2Q1&D0&M5\Q0\J0&W
Siemens	M20T	ATE0S0=2&S0;+IFC=0,0;+CMEE=1;+IPR=9600&W

8.3.2 RS-232C Straight Cable Between Modem and AL2-GSM-CAB

Figure 8.5: RS-232C Straight Cable Reference Between a Modem and AL2-GSM-CAB



8.3.3 Modem Setting

1) Setting of personal computer side

Install the file for the setting of the attachment in the modem.

2) Setting of α2 series side

The modem on the α2 series side is set by the ModemInit command of the main unit.

a) About the modem command (AT command)

Use the AT command to initialize the modem. Confirm details of the AT command in the manual of the modem to be used. AT commands have been prepared for select modems in the table 8.4 (normal modem) and 8.5 (GSM modem) below.

Table 8.3: Tested Modems

Maker name	Model name	Modem command (AT command)
3com	SP560V-P	ATE0Q1&B1&D0H0&I0&R1&S0S0=2S15=8&W
OMRON	ME3314	ATE0S0=2Q1&D0S15=8&R1&H0&W
AIWA	PV-AF3360	ATE0S0=2Q1&D0&M5\Q0\J0&W
Siemens	M20T	ATE0S0=2&S0;+IFC=0,0;+CMEE=1;+IPR=9600&W

Further information on the method to initialize a modem can be found in the α2 Programming Manual.

When modems not listed in the table above are used, set the AT command to meet the following requirements.

Table 8.4: AT Command for Modem (Normal Modem)

Setting Item	Set content	Example Setting		
		SP560V-P	ME3314	PV-AF3360
Setting of command echo	None	E0	E0	E0
Call frequency of auto-answering	Twice	S0=2	S0=2	S0=2
Displayed result code	None	Q1	Q1	Q1
DTR control	Always on	&D0	&D0	&D0
DSR control	Always on	&S0		
Communicate mode	V.42bis mode	S15=8	S15=8	&M5
Speed of terminal fixed dimension	Fixed	&B1	\J0	
Terminal flow control scheme	None	-&R1	\Q0	
Flow control of transmission data	None	&H0	&H0	-
Flow control of received data (software)	None	&I0		
Flow control of received data (RTS control)	None	&R1		
Writing in nonvolatile memory	Write in the nonvolatile memory.	&W	&W	&W

ENG

Table 8.5: AT Command for GSM Modem

Setting Item	Set content	Example Setting
		M20T
Enable command echo	Echo mode OFF	E0
Set number of ring before automatically answering the call	Enable automatic answering on the ring twice	S0=2
Set circuit data set ready (DSR) function mode	DSR always ON	&S0
Set TE-TA local data flow control	<ul style="list-style-type: none">Specifies the method which will be used by TE when data is received from TA: NoneSpecifies the method which will be used by TA when data is received from TE: None	+IFC=0,0
Report mobile equipment error	Enable result code and use numeric value	+CMEE=1
Set fixed local rate	Baud Rate: 9600 bps	+IPR=9600
Set circuit data carrier detect (DCD) function mode*1	DCD line is ON only in the presence of Data Carrier	&C1
Select bearer service type*1	9600 bps (V.32), asynchronous modem, non-transparent	+CBST=7,0,1
Store current parameter to use defined profile	The user profile is stored in non-volatile memory	&W

*1 In Siemens M20T case, these settings are not necessary because they are default settings. If using other GSM Modem, maybe these settings are necessary.

b) Timing to initialize the modem during system startup

In the α 2 series, there is a function to delay the transmission of the modem command (AT command) to initialize the modem from the main unit at start up. The delay can range from 0 - 10 seconds. This command can be useful to ensure the AT command is correctly transmitted when the α 2 series start up is faster than the modem start up.

Further information for the modem operation can be found in the α 2 Programming Manual and the α Software Manual.

MEMO

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9. AL2-ASI-BD (AL2-14MR-*, AL2-24MR-*)

The AL2-ASI-BD Actuator Sensor Interface board module is used in conjunction with α 2 series controller for data communication over an Actuator Sensor Interface (AS-interface) network.

Further information can be found in the α 2 Series Programming Manuals.



Caution

- Persons trained in the local and national electrical standards must replace the AL2-ASI-BD.
- Turn off the power supply when you install or remove the AL2-ASI-BD.
- Replace the cover after removing the AL2-ASI-BD.
- Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.

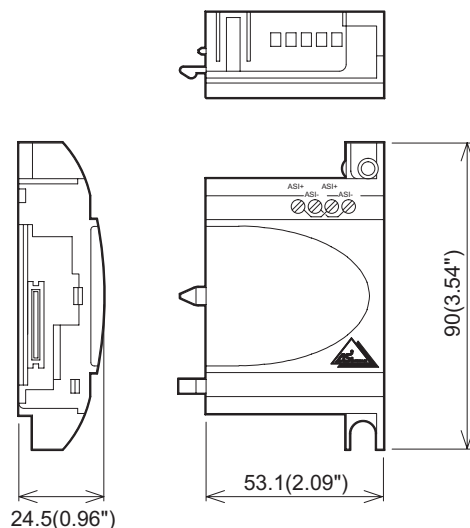
9.1 Introduction

The AL2-ASI-BD connects onto the main unit of the α 2 series controller, forming a slave station for an AS-interface network (Input 4 points, Output 4 points). A maximum of 31 slaves can be connected to form an AS-interface network. Power for the communication is supplied over the AS-interface bus by the AS-interface power supply. The communication signal is superimposed over the power supply on the AS-interface bus.

9.1.1 External Dimensions

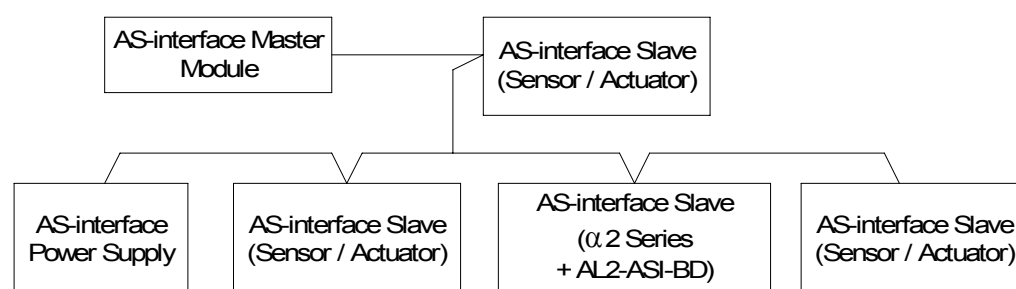
Figure 9.1: External Dimensions

Unit: mm (inches)



9.1.2 System Configuration

Figure 9.2: System Configuration



ENG

9.2 Specifications

For general specifications please refer to the Chapter 2.

Table 9.1: Hardware Communication Specifications

Item		Content
Number of I/O		4 Input (E01-E04) 4 Output (A01-A04)
I/O Refresh Time		Max. 5ms
Network Distance		Max. 100m
External Power Voltage		Typ. 30.5V DC (AS-interface Power supply)
External Power Current Consumption		40 mA or less
EC Directive		EMC
Complies with		AS-interface Certification

Table 9.2: Software Communication Specifications

Item		Content
Station Number		Set by Master Station (Factory default 0)
IO Code		7
ID Code		F
Data Bit	D0 - D3	Input/Output 01 - 04 (E01 - E04, A01 - A04)
Parameter Bit	P0	Communication monitor (set by default). ^{*1}
	P1,P2,P3	Unused
System Bit	M6	"ON" when communication Error of AS-interface occurs
	M7	"ON" when communication Error by AS-interface power fail occurs
Control Bit	N1	ON: Connect to AS-interface network OFF: Unconnected to AS-interface network

^{*1} Function to reset input signal (E01 - E04) when AS-interface communication is cut for 70 ms or more.

9.3 Wiring & Installation

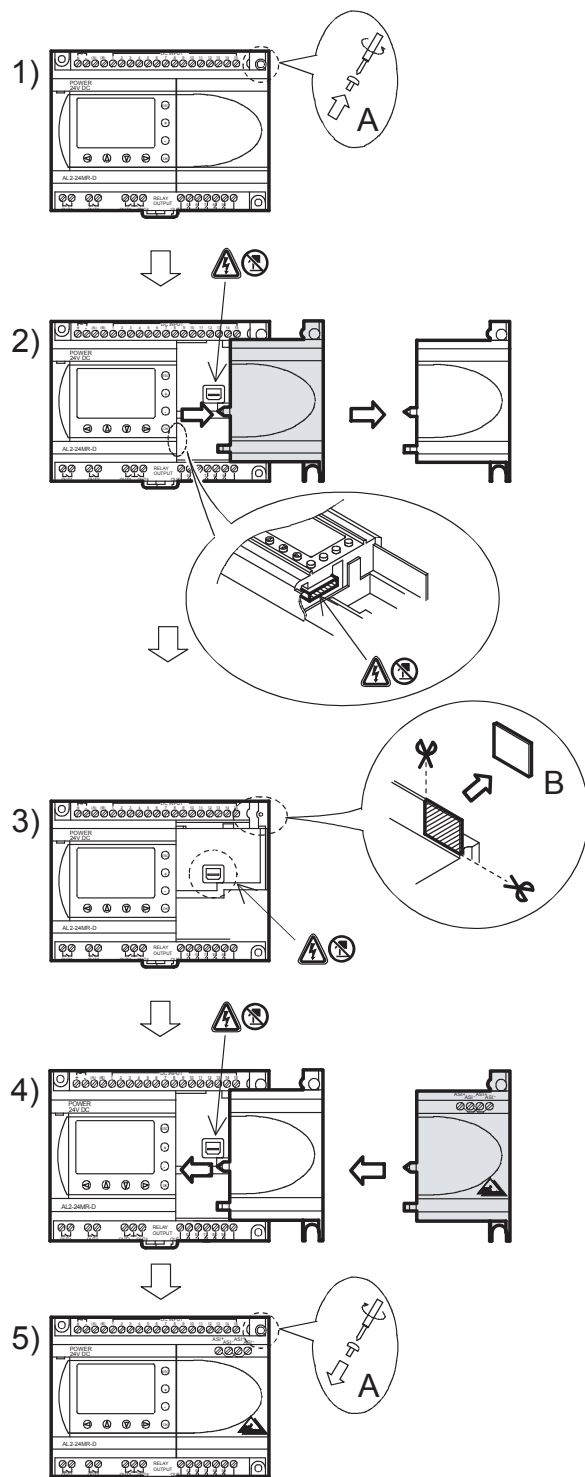
9.3.1 Installation



Caution

Disconnect all terminals from the power supply before removing the cover.

Figure 9.3: Installation



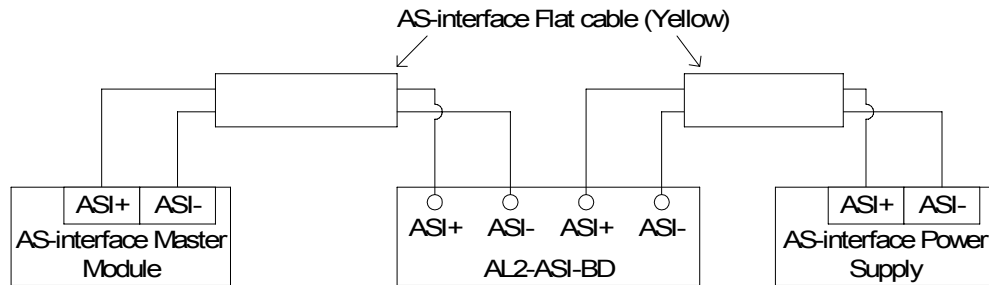
- 1) Release screw 'A' and keep.
- 2) Carefully remove the factory fitted expansion port cover.
- 3) Cut away section 'B' from the α 2 series controller main unit.
- 4) Attach the expansion module to the main unit.
- 5) Tighten screw 'A' to a torque of 0.4 N·m.

9.3.2 Wiring



Use the AS-interface flat cable (yellow) for connecting the AL2-ASI-BD to the network. When connecting AS-interface cable to the module, tighten communication connector pin screws to a torque of 0.5 - 0.6N·m.

Figure 9.4: Wiring



ENG

9.4 Slave Address Setting & Diagnostics

9.4.1 Setting Slave Address

The address of AL2-ASI-BD must be set from the AS-interface master module. The setting range of the slave address is 1 to 31. New modules are preset to 0 before shipping, if a module has been previously assigned an address other than 0, it must be reset to 0 before it need to add into new AS-interface network.

Refer to the AS-interface master module's manual for details of how to set station address from the AS-interface master.

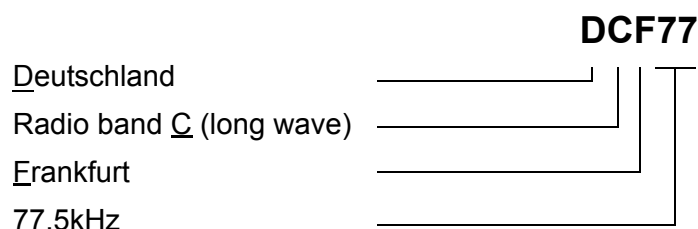
Many modules can be added to a network at one time, all but one of them should be set in their passive state (set N1=1). Once the network has been powered up the modules can be individually activated (set N1=0), where the Master station will assign a slave address.

9.4.2 Applicable Error checks

- 1) If a Communication error (M6) occurs;
 - Check connections to the AS-interface master, and that the slave station number is correct.
- 2) If a Communications power supply error (M7) occurs;
 - Check the connection of the AS-interface Bus cable at each affected unit, also the AS-interface power supply and its operation.

10. DCF77 Radio Clock

The DCF77 function for the α 2 series provides automatic setup of the RTC (Real Time Clock) from receiving and decoding DCF77 time information that is broadcast over the radio signal 77.5kHz from Frankfurt/Germany.



10.1 Introduction

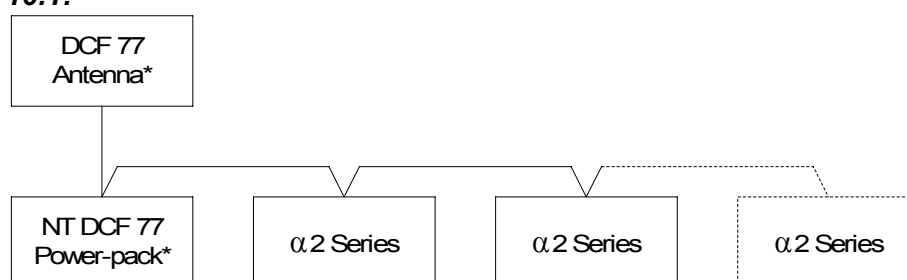
Table 10.1: Radio Clock

Item	Content
Transmitter location	Mainflingen, 25km south of Frankfurt/Germany
Frequency	77.5kHz
Transmission Range	2000km
Coding	BCD (Binary Coded Decimal)
Transmitted Data	minutes, hours, calendar day, day of the week, month, year
Transmission Time	24 hours daily

The carrier amplitude is reduced to 25% at the beginning of each second for a period of 100ms (binary:0) or 200ms (binary:1), except for the 59th second.

10.2 System Configuration

Figure 10.1:



* Manufactured by Theben AG

The α2 series must use a Theben DCF77 antenna and at least one Theben device to power the antenna. The α2 series internal decoding will only recognise a Theben DCF77 signal.

The extra Theben device must power the antenna with 12V DC, only a Theben power supply can be used to provide the required power and signal line.

A maximum of 10 α2 series main units can be connected in one configuration.

10.3 Specifications

For general specifications please refer to Chapter 2.

Table 10.2: Theben DCF77 Antenna

Item	Content
Part Name	DCF 77 Antenna 907 0 243
Ambient Temperature	-20 - 70°C
Protection	IP 54
Reception Threshold	100μV/m
Reception Area	approx. 1000km from Frankfurt
Connection cable length	max. 200m
Polarity	none



Caution

- To avoid interference from external signals, do not use the Theben DCF77 antenna in TV, PC or telecommunications areas.

Table 10.3: Theben Power-pack

Item	Content
Part Name	Power pack NT DCF 77 907 0 182
Operating Voltage	230V AC~ +/-10%
Nominal frequency	50-60Hz
Internal consumption	max. 3VA
Power-line length	max. 200m individually conducted two-core power line
Capacity	10 units
Protection class	II acc. to EN 60335
Protection	IP20 acc. to EN 60529

Table 10.4: Applicable Version

PLC Type	Applicable version
α2 Series (DC Version only)	V2.00 or later
VLS Software	V2.30 or later



Caution

- The AC version of the α2 series cannot be used to receive DCF77 radio signals.
- Only analog inputs that are available with the DC version of the α2 series can be used to decode DCF77 radio signals.

Table 10.5: Software Specifications

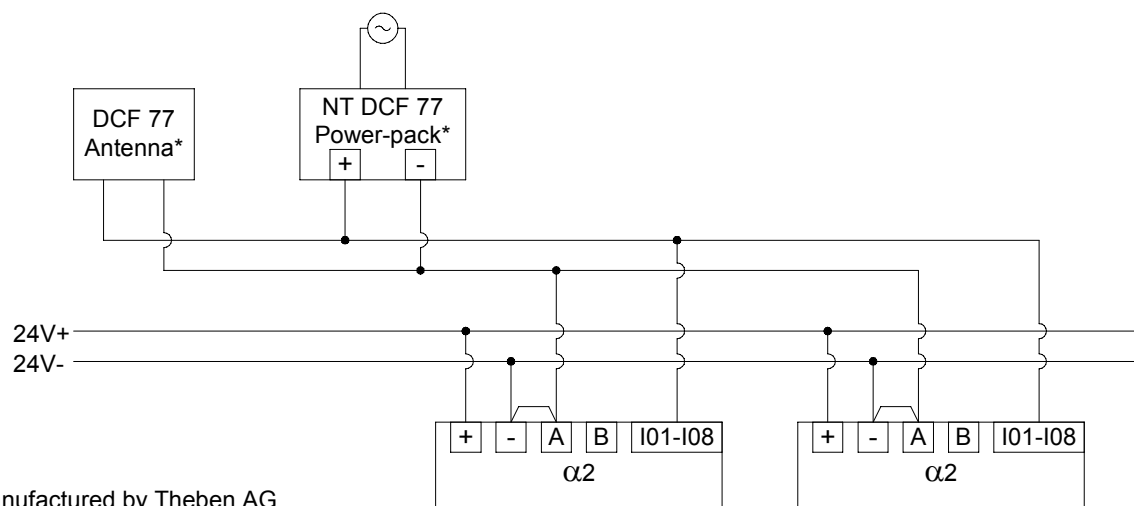
Item	Content
System Bit	M10 "ON" during DCF77 decoding
	M11 Pulses "ON" when DCF77 finishes decoding without an error
	M15 "ON" when DCF77 finishes decoding an error

For further Front programming details please refer to the α2 Programming Manual (JY992D97101).

10.4 Wiring

10.4.1 Wiring

Figure 10.2: Wiring



* Manufactured by Theben AG

The α2 series controller must be wired for a source configuration, otherwise, the DCF77 signal will not be received and decoded at the analog inputs.

Table 10.6: Wiring conditions

Item	Description
α2 Series Antenna signal inputs	AL2-10MR-D:I01 - I06 AL2-14MR-D,AL2-24MR-D:I01 - I08
Max. α2 Series controllers	10 units
Max. wiring distance from antenna	200m

10.4.2 DCF77 Setup from α2 display

- 1) From the TopMenu, scroll to "ClockSet" and press the "OK" key. From the options that appear, scroll to "Radioclock" and press the "OK" key. Only one option appears if the Radioclock has not been activated. Scroll to "Radioclock" and press the "OK" key.

```
RadioClock
» RadioClock
```

ENG

- 2) From the options that appear, scroll to "DCF77" and press the "OK" key.

```
RadioClock
» Not Use
   DCF77
```

- 3) Choose the α2 Analog Input (I01-I08) that carries the DCF77 antenna signal. More options will appear under the Radioclock menu. Scroll to "Input" and press the "OK" key.*1

```
RadioClock
RadioClock
» Input
   TimeDiffer
```

- 4) Enter the Analog Input (I01-I08) with the +, - buttons and press the "OK" key.

```
RadioClock
Input
   I01
```

- 5) Adjust for the timezone difference between Frankfurt Germany and the controllers' location. This amount is added to the received time. Scroll to "TimeDiffer" and press the "OK" key.

```
RadioClock
RadioClock
Input
» TimeDiffer
```

- 6) Select the timezone difference in half hour increments using the +,- buttons. Press "OK" to select the current timezone difference.

```
RadioClock
TimeDiffer
   0.0hrs
```

- 7) The time signal decoding can be manually stopped or started. Scroll to "Manual" and press the "OK" key.

```
RadioClock
Input
TimeDiffer
» Manual
```

- 8) Press the "OK" or "ESC" keys to preform an execute or cancel operation.

Manual
Stop Act .
OK or ESC

Note

- *1 The α 2 Controller will alternate between "No signal" and "Radioclock" if the DCF77 signal is not received and decoded.

10.4.3 Automatically Start

The DCF77 Radioclock decoding phase will start automatically if the following conditions are satisfied:

- 1) The α 2 Real Time Clock (RTC) reaches 1.00am.
- 2) The α 2 Real Time Clock (RTC) will produce an error after Powering ON the controller.

10.4.4 Automatically Stop

The DCF77 Radioclock decoding phase will stop automatically if the following conditions are satisfied:

- 1) The α 2 Real Time Clock (RTC) was configured correctly and a valid time was received
- 2) No valid time was received during 30 minutes of retries.

10.4.5 Verification of Received Time

The DCF77 Radioclock decoded time is checked for validity based on the following three items:

- 1) Parity Check - The DCF77 time code data frame is protected by 3 (even) parity bits. The first parity bit protects the minute data, the second protects the hour data and the third parity bit protects the day, day of the week, month and year data.
- 2) Data Range Check -
 - a) $0 \leq \text{minutes} \leq 59$
 - b) $0 \leq \text{hours} \leq 23$
 - c) $1 \leq \text{days} \leq 31$
 - d) $1 \leq \text{month} \leq 12$
 - e) $0 \leq \text{year} \leq 59$
- 3) Time Difference Check - The difference between two received time frames must equate to 1 minute, thus, the total time (in minutes from 1990/01/01) of every time frame is referenced.



Caution

- When "Start Act." is used to manually start DCF77 decoding, the user must check the state of M10 (decoding active flag) 30 minutes after starting the decoding. If M10 is off, DCF77 decoding finished without error. If M10 is still ON, there is a problem with either the wiring or the availability of the signal in the location of use. The user should check both possible causes.

MEMO

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11. AL2-2DA (AL2-14MR-*, AL2-24MR-*)

The AL2-2DA Analog Output module should be used with the α2 Series Controller for 2 channels of either voltage or current output.

Further information can be found in the α2 Series Programming Manual and the AL2-2DA Installation Manual.



Caution

- Persons trained in the local and national electrical standards must perform all tasks associated with wiring the α2 Series Controller.
- The α2 Series is not designed to be used in life critical or fail safe applications.
- Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.
- Securely install the AL2-2DA to the α2 Series controller to avoid any malfunction.



EMC Caution

Mitsubishi Electric α2 Series Analog module has been found to be compliant to the said European standards and directive. However, (for the very best performance from what are in fact delicate measuring and controller output devices) Mitsubishi Electric would like to make the following points:

- As analog modules are sensitive by nature, their use should be considered carefully. For users of proprietary cables (integral with sensors or actuators), these users should follow those manufacturers installation requirements.
- Mitsubishi Electric recommends that shielded cables should be used. If NO other EMC protection is provided, then users may experience temporary errors not exceeding +10%/-10% in very heavy industrial areas. However, Mitsubishi Electric suggest that if adequate EMC precautions are followed with general good EMC practise for the users complete control system, users should expect normal errors as specified in each independent product manual.

11.1 Introduction

The AL2-2DA Analog Output Module (hereafter called "AL2-2DA") is to be installed onto an α2 Series Controller and should be used to convert a digital value to a voltage (0-10V) or current (4-20mA) analog output signal.

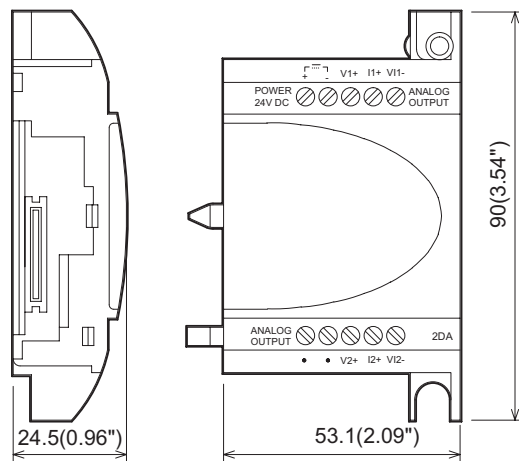
The AL2-2DA is to be used in conjunction with the α2 Series Controller's Analog Output (AO) function block. Refer to the α2 Programming manuals for further details.

ENG

11.1.1 External Dimensions

Figure 11.1: External Dimensions

Unit: mm (inches)



11.1.2 System Configuration

For general specifications please refer to Chapter 2.

Table 11.1: Applicable Version

PLC Type	Applicable version
AL2-14MR-*, AL2-24MR-*	V2.00 or later
VLS Software	V2.30 or later



Note

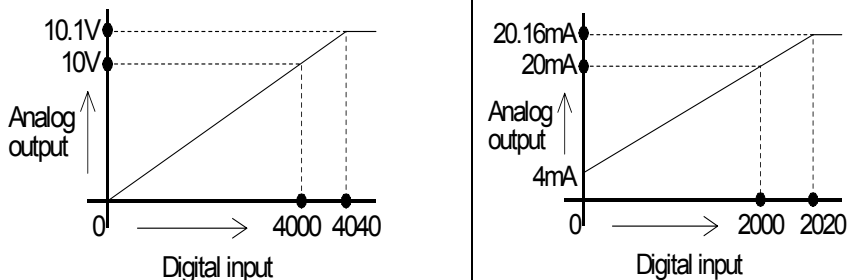
- 1) The AL2-2DA cannot be used together with either an AL2-4EX-A2, AL2-4EX, AL2-ASI-BD, AL2-4EYR or AL2-4EYT.
- 2) The AL2-2DA cannot be used with the original α Series Controllers.

11.2 Specification

Table 11.2: Power Specification

Item	Content
Integrated Power Supply	Supplied from the α2 Main Unit
External Supply for Analog output	24V DC
External Supply current consumption	70mA

Table 11.3: Hardware Specification

Item	Specification	
	Voltage	Current
Analog Output Range	0 - 10V DC (External load resistance 5k - 1MΩ)	4 - 20mA (External load resistance less than 500Ω)
Digital Input	0 to 4000	0 to 2000
Resolution	2.5mV (10V / 4000)	8μA ((20-4)mA / 2000)
Integrated accuracy	+/- 1% Full scale (0-10V : +/-0.1V)	+/- 1% Full scale (4-20mA : +/-0.16mA)
D/A Conversion Time	20ms (10ms x 2ch)	
Isolation Circuit	Photocoupler	
Input Characteristics		



Note

- 1) When the external load resistance is 5kΩ to 1MΩ, the overall accuracy of the voltage output is adjusted to “+/-1%”. (Factory calibration point is 10kΩ external load)
If the load resistance is smaller than 5kΩ, the output voltage becomes smaller than the correct value.
- 2) If the current output mode is used, an external load resistance of 500Ω or less must be used.
If the load resistance exceeds 500Ω, the output current will be lower than the correct value.

Table 11.4: Software Specification

Item	Content
System Bit	M16 “ON” when external power for the AL2-2DA

11.3 Wiring & Installation

11.3.1 Installation

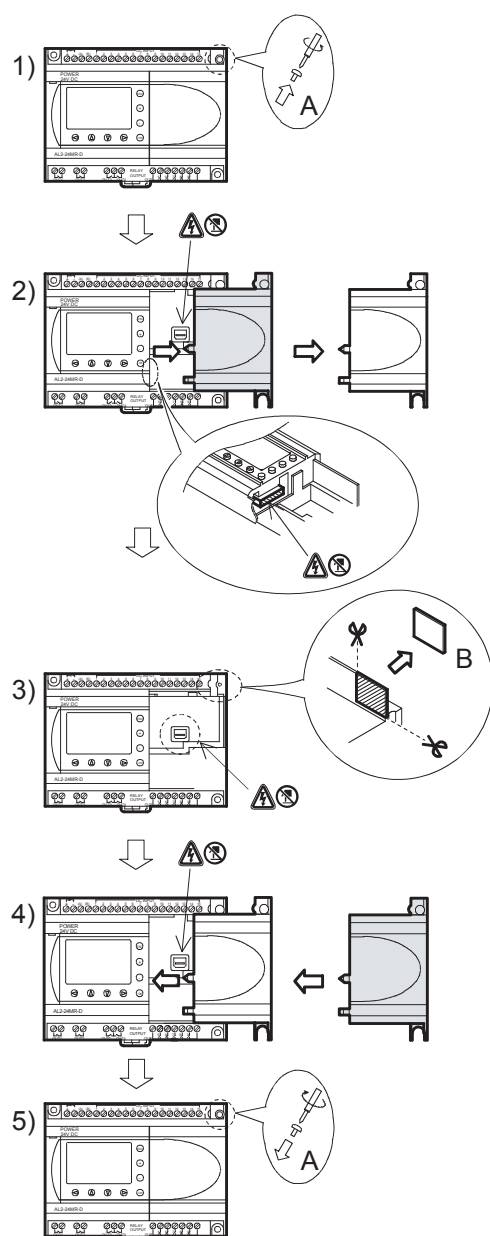


Caution

- Disconnect all terminals from the power supply before installing the AL2-2DA.
- Do not install in areas with: excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration.
- The α 2 Series Controller and AL2-2DA must be installed in a distribution box or a control cabinet.
- Leave a minimum of 10 mm (0.40") of space for ventilation between the top and bottom edges of the α 2 Series Controller and the enclosure walls.

ENG

Figure 11.2: Installation



- 1) Release screw 'A' and keep.
- 2) Carefully remove the factory fitted expansion port cover.
- 3) Cut away section 'B' from the α 2 series controller main unit.
- 4) Attach the expansion module to the main unit.
- 5) Tighten screw 'A' to a torque of 0.4 N·m.

11.3.2 Wiring



Caution

- Turn off the Power before performing any wiring operations.
- The Output cables should not be run through the same multi core cable or share the same wire.
- The wire should be used as a single cable or the multi core wires (can be used with a crimp terminal) should be carefully twisted together.
Do not connect a soldered wire end to the α2 Series Controller.
- The Output cable length must be less than 30 m (98' 5")
- To avoid damaging the wire, tighten to a torque of 0.5 - 0.6 N·m.
- The connectors must be covered to prevent contact with "Live" wires.

Figure 11.3:Wiring in Voltage output mode

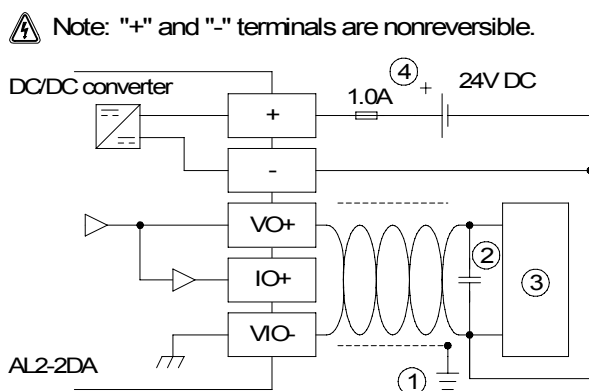


Figure 11.4:Wiring in Current output mode

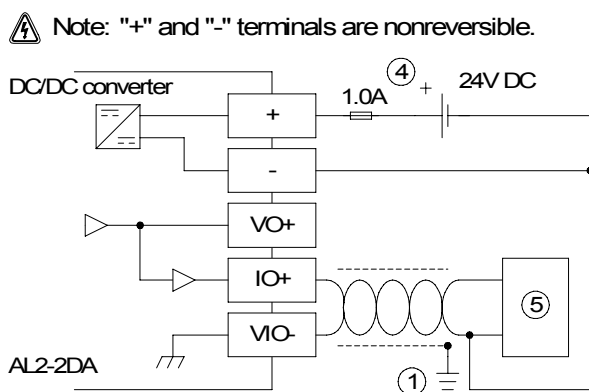


Table 11.5: Wiring Notation

Item	Description
1	Grounding resistance of 100Ω or less
2	In the case of apparent excess noise please connect a 0.1-0.47μF capacitor
3	External equipment such as an Inverter, etc.
4	External 24VDC power supply
5	External equipment such as a Record meter, etc.

11.3.3 Applicable Error checks

- 1) If an External power supply error (M16) occurs:

Check the “+” and “-” connections to the AL2-2DA for correct wiring and installation procedures.

Check the original Power Supply source for 24V DC operation.

ENG

12. AL2-2PT-ADP

The AL2-2PT-ADP PT100 adaptor module (hereafter called “AL2-2PT-ADP”) should be used to amplify PT100 temperature input to 0 - 10V voltage analog signal for use in the main unit.

Further information can be found in the AL2-2PT-ADP Installation Manual.



Caution

- Persons trained in the local and national electrical standards must perform all tasks associated with wiring the α2 Series Controller and AL2-2PT-ADP.
- The α2 Series is not designed to be used in life critical or fail safe applications.
- Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.



EMC Caution

Mitsubishi Electric α2 Series Analog modules has been found to be compliant to the said European standards and directive. However, (for the very best performance from what are in fact delicate measuring and controller output devices) Mitsubishi Electric would like to make the following points:

- As analog modules are sensitive by nature, their use should be considered carefully. For users of proprietary cables (integral with sensors or actuators), these users should follow those manufacturers installation requirements.
- Mitsubishi Electric recommends that shielded cables should be used. If NO other EMC protection is provided, then users may experience temporary errors not exceeding +10%/-10% in very heavy industrial areas. However, Mitsubishi Electric suggest that if adequate EMC precautions are followed with general good EMC practise for the users complete control system, users should expect normal errors as specified in each independent product manual.

12.1 Introduction

The AL2-2PT-ADP should be used convert PT100 Temperature input (-50 - 200°C) to a voltage equivalent (0 - 10V) for direct use in the main unit.

12.1.1 External Dimensions

Figure 12.1: External Dimensions

Unit:mm (inches)

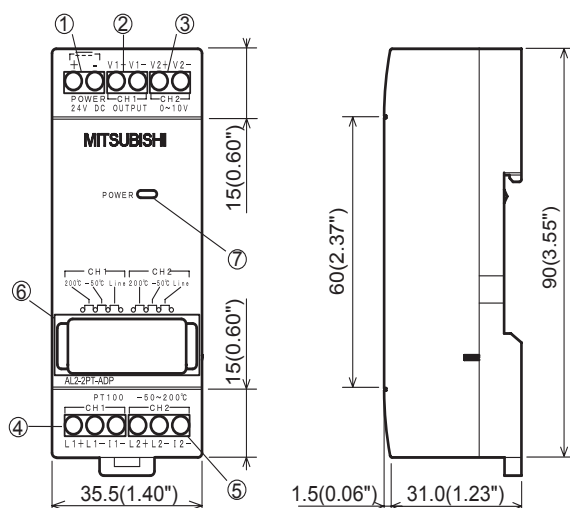


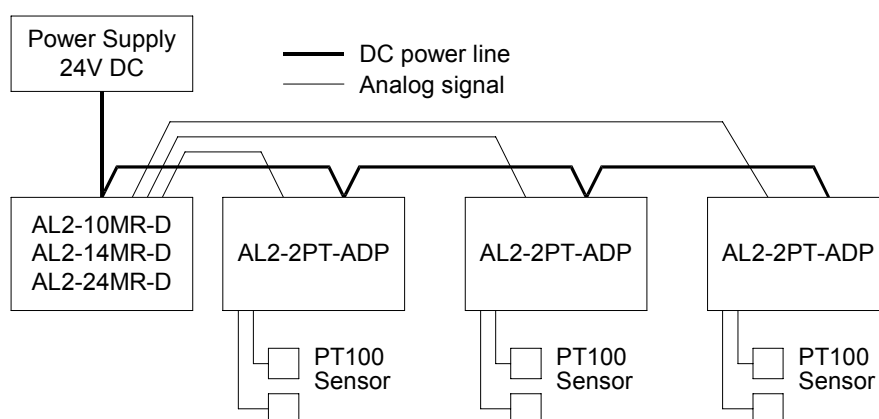
Table 12.1:

Item	Description
1	+24V DC Power Supply
2	Channel 1 Voltage Output Terminal
3	Channel 2 Voltage Output Terminal
4	Channel 1 PT100 Sensor Input Terminal
5	Channel 2 PT100 Sensor Input Terminal
6	Jumper pins for adjustment
7	Power LED

ENG

12.2 System Configuration

Figure 12.2:



For general specifications please refer to Chapter 2.

Table 12.2: Applicable Version

PLC Type	Applicable version
α2 Series (DC Version only)	V2.00 or later
VLS Software	V2.30 or later



Note

The AL2-2PT-ADP cannot be used with the original α Series Controllers.

12.3 Specification

Table 12.3: General Specification

Item	Content
Operating Temperature	(-25) - 55°C / (-13) - 131°F
Storage Temperature	(-30) - 70°C / (-22) - 158°F
Humidity	35 - 85% Relative humidity, no condensation
Vibration Resistance - DIN Rail mounting	Conforms to IEC 68-2-6; 10-57: Hz: 0.075mm Constant Amplitude 57-150Hz: 9.8m/s ² Acceleration. Sweep Count for X, Y, and Z: 10 times (80 minutes in each direction)
Shock Resistance	Conforms to IEC 68-2-27: 147m/s ² Acceleration, Action Time: 11ms 3 times in each direction X, Y and Z
Noise Immunity	1000 Vpp, 1μs, 30-100Hz tested by a noise simulator
Dielectric Withstand Voltage	500V AC ~> 1min per IEC60730-1 between all terminals and the DIN43880 control box or equivalent.
Insulation Resistance	7MΩ 500V DC IEC60730-1 between all terminals and the DIN43880 distribution box or equivalent
Operation Ambience	To be free of corrosive gases

Table 12.4: Power Specification

Item	Content
External Supply for Analog output	24V DC +20%, -15%
Power consumption	1.0W

Table 12.5: Adjustment Standard

Item		Content
EC Directive	EMC Directive	EN61000-6-1
		EN61000-6-2
		EN61000-6-3
IEC		IEC60730-1
UL, CUL		UL508

Table 12.6: Hardware Specifications

Item	Specification	
	Centigrade (°C)	Fahrenheit (°F)
Input Specification	Platinum temperature PT100 sensors (100Ω), 3-wire, Temperature coefficient: JIS C 1604-1997 (IEC 751)	
Compensated Range	-50°C - 200°C	-58°F - 392°F
Overall accuracy	±1.5% (range of all temperatures) and ±1.0% (at 25°C)	±1.5% (range of all temperatures) and ±1.0% (at 77°F)
Resolution	0.5°C / digit	
D/A Conversion Time	20.5ms	
Isolation Circuit	No isolation between channels (input/output) and power	

Table 12.6: Hardware Specifications

Item	Specification	
	Centigrade (°C)	Fahrenheit (°F)
Input Characteristics	<p>Digital</p> <p>+2000</p> <p>+2075</p> <p>+207.5°C</p> <p>-50°C</p> <p>-57.5°C</p> <p>-500</p> <p>+200°C (PT100)</p> <p>Temperature</p>	<p>Digital</p> <p>+3920</p> <p>+4055</p> <p>+405.5°F</p> <p>-58°F</p> <p>-71.5°F</p> <p>-580</p> <p>+392°F (PT100)</p> <p>Temperature</p>

ENG

Table 12.7: Software Specification

Item		Content	AL2-10MR-D	AL2-14MR-D AL2-24MR-D
System Bit	M17	“ON” when there is a sensor defect at I01	✓	✓
	M18	“ON” when there is a sensor defect at I02	✓	✓
	M19	“ON” when there is a sensor defect at I03	✓	✓
	M20	“ON” when there is a sensor defect at I04	✓	✓
	M21	“ON” when there is a sensor defect at I05	✓	✓
	M22	“ON” when there is a sensor defect at I06	✓	✓
	M23	“ON” when there is a sensor defect at I07	—	✓
	M24	“ON” when there is a sensor defect at I08	—	✓

12.4 Wiring and Installation

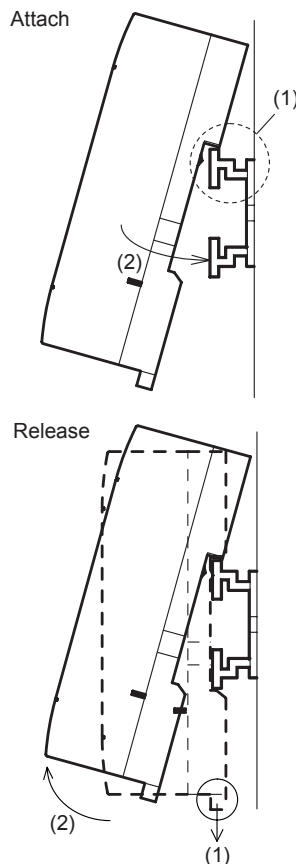
12.4.1 Installation



Caution

- Do not install in areas with: excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration.
- The connectors must be covered to prevent contact with “Live” wires.
- The α 2 Series Controller and AL2-2PT-ADP must be installed in a distribution box or a control cabinet. The distribution box should be equipped with a cover for the AL2-2PT-ADP module to avoid any possible foreign objects from falling inside.
- Leave a minimum of 10mm (0.40") of space for ventilation between the top and bottom edges of the AL2-2PT-ADP and the enclosure walls.
- The maximum distance between the α 2 Series Controller and the AL2-2PT-ADP should be 3m (9'10") or less.
- The power cable should be less than 10m in length.
- A sensor with insulation rated for 500V or more should be used when the sensor is placed near a conductive material.

Figure 12.3: Installation



Units can be snap mounted to 35mm DIN rail (DIN EN 50022). To release the unit pull the spring loaded clips away from the rail and slide the unit off and up.

1) To Attach

Align the upper side of the AL2-2PT-ADP DIN rail mounting groove with the DIN rail (1) and push it onto the rail (2).

2) To Release

Pull the DIN rail hook (1) and remove the AL2-2PT-ADP.

12.4.2 Wiring

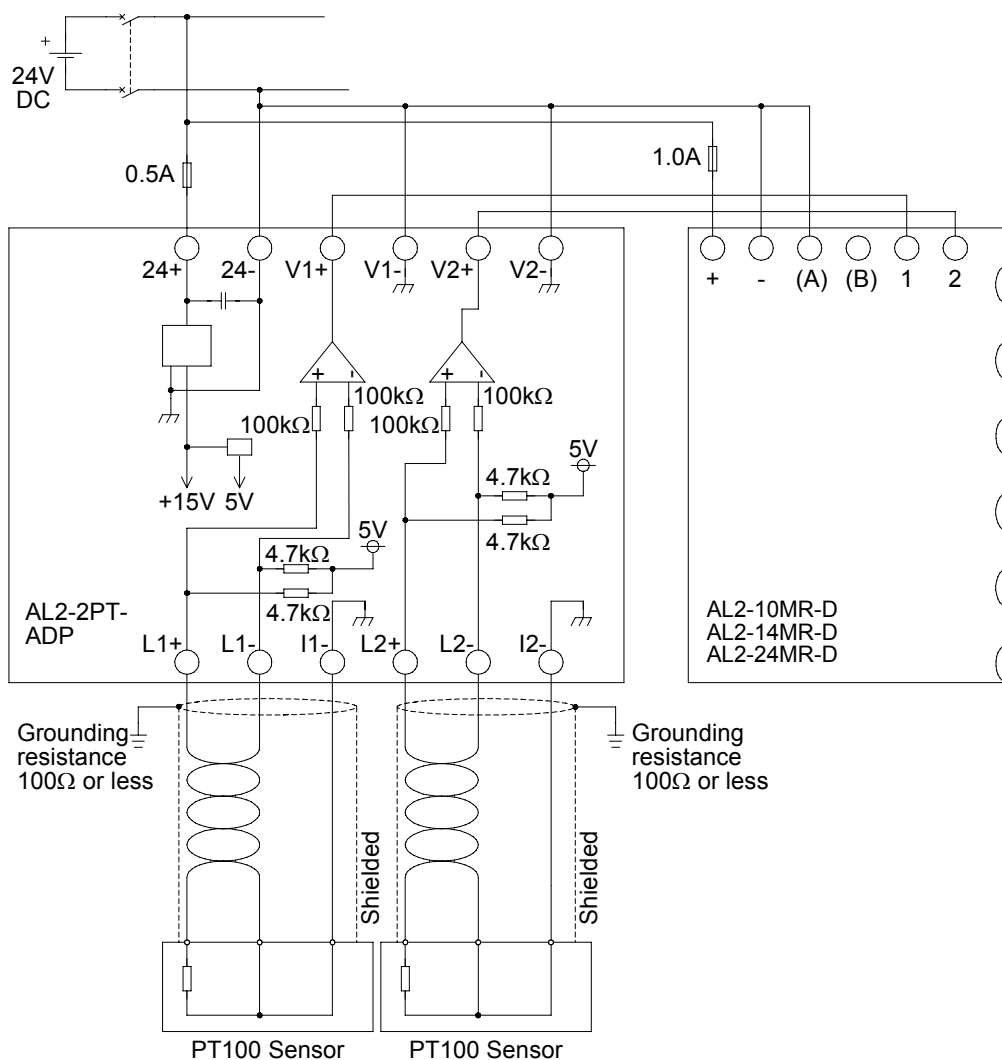


Caution

- Please use an isolated Power supply and turn off the Power before any wiring operation is performed.
- Input and Output cables should not be run through the same multi core cable or share the same wire.
- Input cable (from sensor to AL2-2PT-ADP) must be less than 10m (32'81") and the output cable length must be less than 3m (9'10").
- The wire should be used as a single cable or the multi core wires (can be used with a crimp terminal) should be carefully twisted together.
Do not connect a soldered wire end to the AL2-2PT-ADP.
- To avoid damaging the wire, tighten to a torque of 0.5 - 0.6 N·m.
- The AL2-2PT-ADP should be adjusted for offset and gain purposes, therefore, turn off the Power before performing the adjustment wiring.

ENG

Figure 12.4:Wiring



12.4.3 Choosing a Temperature Scale

- 1) Turn on the power to the α 2 controller and select “Others...” from the TopMenu.

```
TopMenu
ClockSet
LANGUAGE
»Others...
```

- 2) Select “Analog In” from the Others... menu.

```
Others...
Serial Com
Light Time
»Analog In
```

- 3) Select “Temp. Scale” from the Analog In menu.

```
Analog In
I07
I08
»Temp. Scale
```

- 4) Choose “Celsius” or “Fahrenheit.” with the OK button

```
Analog In
Temp. Scale
»Celsius
Fahrenheit
```



Only one system of units can be selected per controller.



The values under the Calibrate menu will remain in Celsius, regardless of the system of units that is selected for the controller, as they are the labels for the jumper pins on the Hardware.

12.4.4 Offset Adjustment



Note

If Gain adjustment is complete, then step 3 - 7 are not needed.

- 1) To begin the offset calibration for channel 1, turn off the power to the α2 controller and the AL2-2PT-ADP, remove the temperature sensor and shorten the pins L1- and I1-.
- 2) Remove the top cover from the jumper area and move the jumper to the pins labeled -50°C as in “Hardware Setup” below. The external wiring should be performed as in the Hardware Setup below.



Caution

The jumper should be installed correctly, otherwise, on occasion electrical contact may not occur.

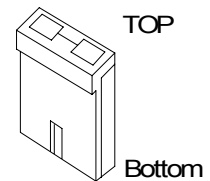
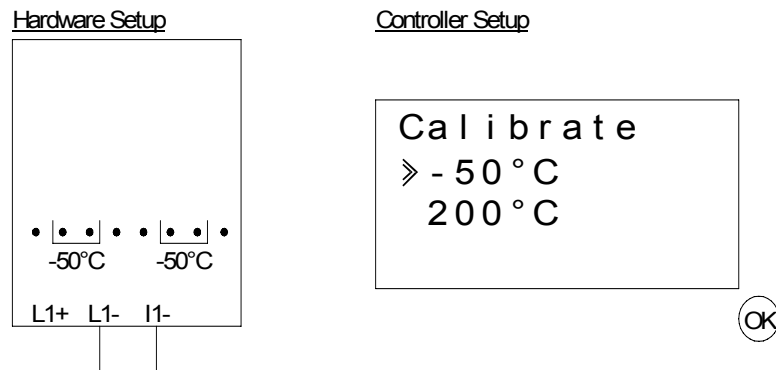


Figure 12.5: AL2-2PT-ADP Offset Adjustment



- 3) Turn the power on and select “Others...” from the TopMenu while in Stop Mode.

```
TopMenu
ClockSet
LANGUAGE
»Others...
```

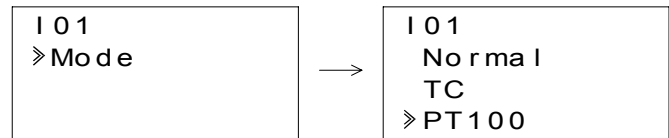
- 4) Select “Analog In” from the “Others...” menu.

```
Others...
Light Time
»Analog In
ProgClear
```

- 5) Select the Input that is connected to the AL2-2PT-ADP module.

```
Analog In
»I 01
I 02
I 03
```

- 6) Configure the input for temperature sensing with the AL2-2PT-ADP module by selecting “Mode” and choosing “PT100” from the following screen.



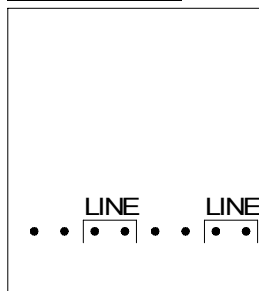
- 7) After setting the mode to “PT100”, select “Calibrate” from the Analog input settings menu.



- 8) Select “-50°C” from the Calibrate menu as in “Controller Setup” in the figure 12.5 and press OK. There should be a confirmation message that reads “OK.” If not, refer to the Applicable Error Checks section below. This completes the offset calibration procedure. To calibrate the offset for channel 2, repeat the steps above replacing L1-, L1+ and I1- with L2-, L2+ and I2- respectively. When the calibration is finished, move the jumper to the “LINE” pins.

Figure 12.6: Jumper position after calibration

Hardware Setup



It is usually necessary to perform the Gain Adjustment when performing the Offset Adjustment. See section 12.4.4 for more details.

12.4.5 Gain Adjustment



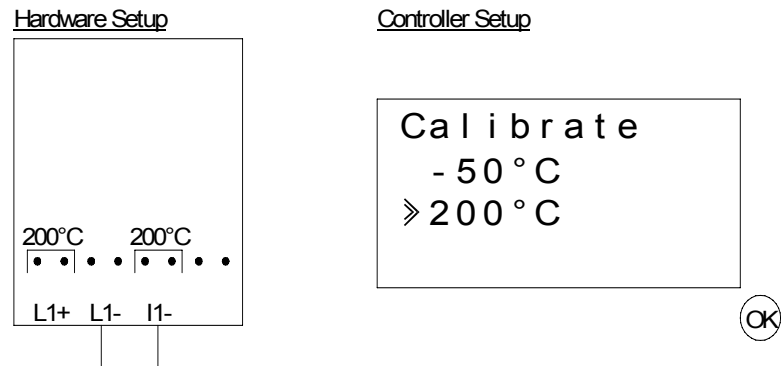
Note

If Offset adjustment is complete, then step 3 - 4 are not needed.

- 1) To begin the calibration for channel 1, turn off the power to the α 2 controller and the AL2-2PT-ADP, remove the temperature sensor and shorten the pins L1- and I1-.

- 2) Remove the top cover from the jumper area and move the jumper to the pins labeled 200°C as in “Hardware Setup” below.

Figure 12.7: AL2-2PT-ADP Gain Adjustment



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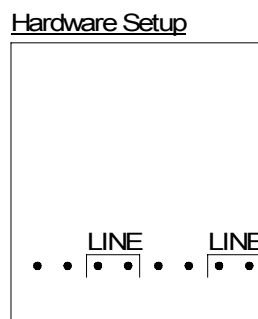
- 3) Turn the power on and select “Others...” from the TopMenu while in Stop Mode.

TopMenu
ClockSet
LANGUAGE
»Others...

- 4) After setting the mode to “PT100” (See the Offset Adjustment description above.), select “Calibrate” from the Analog input settings menu.

I 0 1
Mode
»Calibrate
Offset fine

- 5) Select “200°C” from the Calibrate menu as in “Controller Setup” in the figure 12.7 and press OK. There should be a confirmation message that reads “OK.” If not, refer to the Applicable Error Checks section below. This completes the gain calibration procedure. To calibrate the gain for channel 2, repeat the steps above but replace L1-, L1+ and I1- with L2-, L2+ and I2- respectively. When the calibration is finished, move the jumper to the “LINE” pins.
Jumper position after calibration



It is usually necessary to perform the Offset Adjustment when performing the Gain Adjustment. See section 12.4.3 for more details.

12.4.6 Fine Offset Adjust



The fine adjust should only be performed after both Gain and Offset Adjusts have been performed.

- 1) From the TopMenu, select “Others...”

```
TopMenu
ClockSet
LANGUAGE
»Others...
```

- 2) From the “Others...” menu, select “Analog In”

```
Others...
Light Time
»Analog In
ProgClear
```

- 3) From the Analog In menu select an input that is configured for PT100 input.

```
Analog In
I01
»I02:PT100
I03:TC
```

- 4) Select “Offset fine” from the Analog Input settings menu.

```
I02
Mode
Calibrate
»Offset fine
```

- 5) Using the + and - buttons, enter a value from -15.5°C to 15.5°C (-27.9°F to 27.9°F).
Press the OK button when finished.

```
I02
Offset fine
0.0°C
```

12.4.7 Applicable Error checks

In the event that the input voltage is greater than 11 V or equal to 0V the following system flags will be set.

Table 12.8:

		AL2-10MR-D	AL2-14MR-D AL2-24MR-D
M17	0: Normal 1: Defect at I01	✓	✓
M18	0: Normal 1: Defect at I02	✓	✓
M19	0: Normal 1: Defect at I03	✓	✓
M20	0: Normal 1: Defect at I04	✓	✓
M21	0: Normal 1: Defect at I05	✓	✓
M22	0: Normal 1: Defect at I06	✓	✓
M23	0: Normal 1: Defect at I07	—	✓
M24	0: Normal 1: Defect at I08	—	✓

- If the flags in the table above are activated, check that:

- a sensor is connected
- there is not a break in the sensor connection
- the temperature is not greater than the specified limit
- that power is being supplied to the AL2-2PT-ADP.

- If the “Error” message appears instead of “OK” while offset/gain calibration, check that.

- The power is being supplied to the AL2-2PT-ADP.
- The AL2-2PT-ADP is connected to α 2 correctly.
- The input, which connects the AL2-2PT-ADP is selected for calibration.
- The AL2-2PT-ADP inputs L1- and I1- are shortened.
- The jumper on is placed either on the “-50°C” position or the “200°C” position.
- The calibration menu entry related to the jumper position is selected (“-50°C” or “200°C”).

ENG

13. AL2-2TC-ADP

The AL2-2TC-ADP thermocouple analog sensor adaptor module (hereafter called “AL2-2TC-ADP”) should be used to amplify thermocouple sensor (K type) temperature input to 0-10V voltage analog signal for use in the main unit. Further information can be found in the AL2-2TC-ADP Installation Manual.



Caution

- Persons trained in the local and national electrical standards must perform all tasks associated with wiring the α2 Series Controller and AL2-2TC-ADP.
- The α2 Series is not designed to be used in life critical or fail safe applications.
- Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.



EMC Caution

Mitsubishi Electric α2 Series Analog module has been found to be compliant to the said European standards and directive. However, (for the very best performance from what are in fact delicate measuring and controller output devices) Mitsubishi Electric would like to make the following points:

- As analog module are sensitive by nature, their use should be considered carefully. For users of proprietary cables (integral with sensors or actuators), these users should follow those manufacturers installation requirements.
- Mitsubishi Electric recommends that shielded cables should be used. If NO other EMC protection is provided, then users may experience temporary errors not exceeding +3%/-3% in very heavy industrial areas. However, Mitsubishi Electric suggest that if adequate EMC precautions are followed with general good EMC practise for the users complete control system, users should expect normal errors as specified in each independent product manual.

13.1 Introduction

The AL2-2TC-ADP should be used convert thermocouple sensor (K type) temperature input to 0-10V voltage analog signal for use in the main unit.

13.1.1 External Dimensions

Figure 13.1: External Dimensions

Unit:mm (inches)

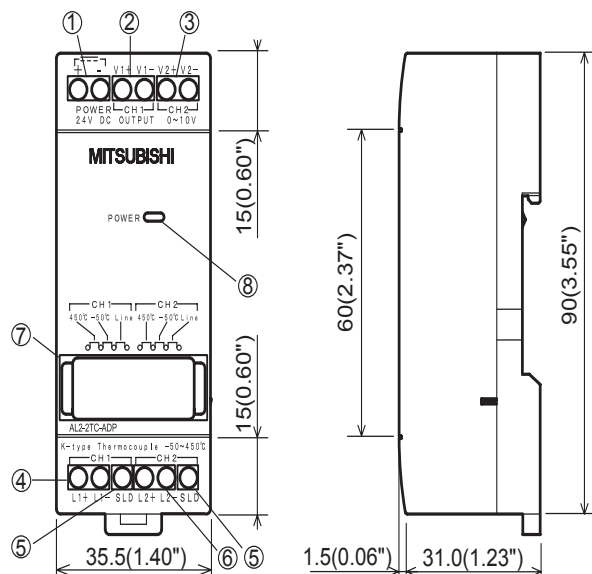
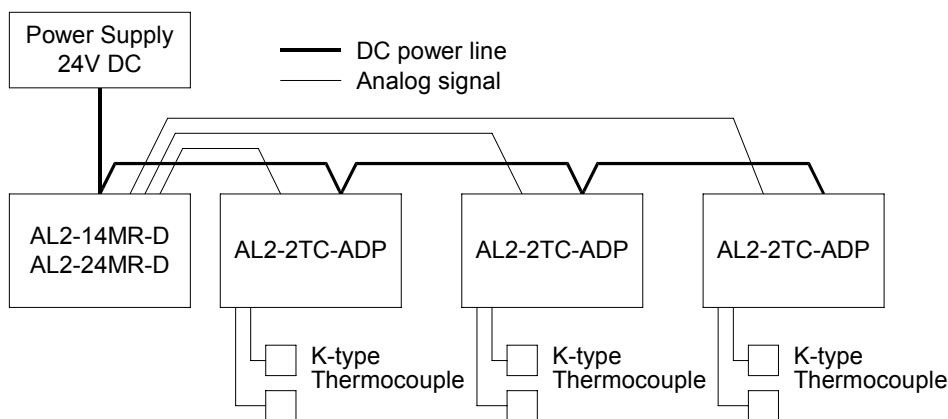


Table 13.1:

Item	Description
1	+24V DC Power Supply
2	Channel 1 Voltage Output Terminal
3	Channel 2 Voltage Output Terminal
4	Channel 1 K-Type Thermocouple Sensor Input Terminal
5	Shield Grounding Terminal
6	Channel 2 K-Type Thermocouple Sensor Input Terminal
7	Jumper pins for adjustment
8	Power LED

13.2 System Configuration

Figure 13.2:



For general specifications please refer to Chapter 2.

Table 13.2: Applicable Version

PLC Type	Applicable version
α2 Series (DC Version only)	V2.00 or later
VLS Software	V2.30 or later



Note

The AL2-2TC-ADP cannot be used with the original α Series Controllers.

13.3 Specification

Table 13.3: General Specification

Item	Content
Operating Temperature	(-25) - 55°C / (-13) - 131°F
Storage Temperature	(-30) - 70°C / (-22) - 158°F
Humidity	35 ~ 85% Relative humidity, no condensation
Vibration Resistance - DIN Rail mounting	Conforms to IEC 68-2-6; 10-57: Hz: 0.075mm Constant Amplitude 57-150Hz: 9.8m/s ² Acceleration. Sweep Count for X, Y, and Z: 10 times (80 minutes in each direction)
Shock Resistance	Conforms to IEC 68-2-27: 147m/s ² Acceleration, Action Time: 11ms 3 times in each direction X, Y and Z
Noise Immunity	1000 Vpp, 1μs, 30-100Hz tested by a noise simulator
Dielectric Withstand Voltage	500V AC ~>1min per IEC60730-1 between all terminals and the DIN43880 control box or equivalent.
Insulation Resistance	7MΩ 500V DC IEC60730-1 between all terminals and the DIN43880 distribution box or equivalent
Operation Ambience	To be free of corrosive gases

Table 13.4: Power Specification

Item	Content
External Supply for Analog output	24V DC +20%, -15%
Power consumption	0.5W

Table 13.5: Adjustment Standard

Item		Content
EC Drective	EMC Directive	EN61000-6-1
		EN61000-6-2
		EN61000-6-3
IEC		IEC60730-1
UL, cUL		UL508

Table 13.6: Hardware Specifications

Item	Specification	
	Centigrade (°C)	Fahrenheit (°F)
Input Specification	Thermocouple K Type, JIS 1602-1995 (IEC 584-1 1977, IEC 584-2 1982), Isolated Type.	
Compensated Range	-50°C - 450°C	-58°F - 842°F
Overall accuracy	±2.0% (range of all temperatures) and ±1.5% (at 25°C)	±2.0% (range of all temperatures) and ±1.5% (at 77°F)
Resolution	1°C / digit	
D/A Conversion Time	20.5ms	
Isolation Circuit	No isolation between channels (input/output) and power	

Table 13.6: Hardware Specifications

Item	Specification	
	Centigrade (°C)	Fahrenheit (°F)
Input Characteristics		

Table 13.7: Software Specification

Item		Content	AL2-10MR-D	AL2-14MR-D AL2-24MR-D
System Bit	M17	“ON” when there is a sensor defect at I01	✓	✓
	M18	“ON” when there is a sensor defect at I02	✓	✓
	M19	“ON” when there is a sensor defect at I03	✓	✓
	M20	“ON” when there is a sensor defect at I04	✓	✓
	M21	“ON” when there is a sensor defect at I05	✓	✓
	M22	“ON” when there is a sensor defect at I06	✓	✓
	M23	“ON” when there is a sensor defect at I07	—	✓
	M24	“ON” when there is a sensor defect at I08	—	✓

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13.4 Wiring and Installation

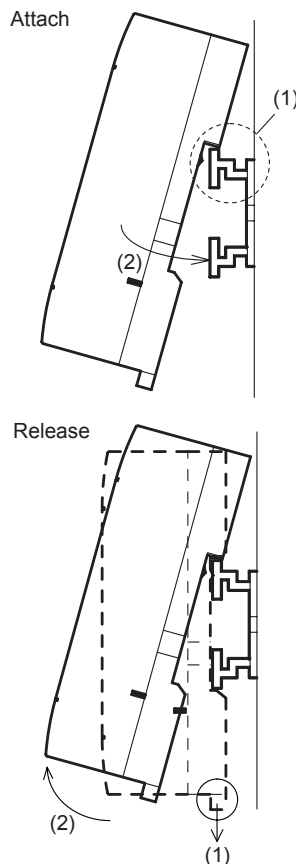
13.4.1 Installation



Caution

- Do not install in areas with: excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration.
- The connectors must be covered to prevent contact with “Live” wires.
- The α 2 Series Controller and AL2-2TC-ADP must be installed in a distribution box or a control cabinet. The distribution box should be equipped with a cover for the AL2-2TC-ADP module to avoid any possible foreign objects from falling inside
- Leave a minimum of 10mm (0.40") of space for ventilation between the top and bottom edges of the AL2-2TC-ADP and the enclosure walls.
- The maximum distance between the α 2 Series Controller and the AL2-2TC-ADP should be 3m (9'10") or less.
- The power cable should be less than 10m in length.
- A sensor with insulation rated for 500V or more should be used when the sensor is placed near a conductive material.

Figure 13.3: Installation



Units can be snap mounted to 35mm DIN rail (DIN EN 50022). To release pull the spring loaded clips away from the rail and slide the unit off and up.

1) To Attach

Align the upper side of the AL2-2TC-ADP DIN rail mounting groove with the DIN rail (1) and push it onto the rail (2).

2) To Release

Pull the DIN rail hook (1) and remove the AL2-2TC-ADP.

13.4.2 Wiring

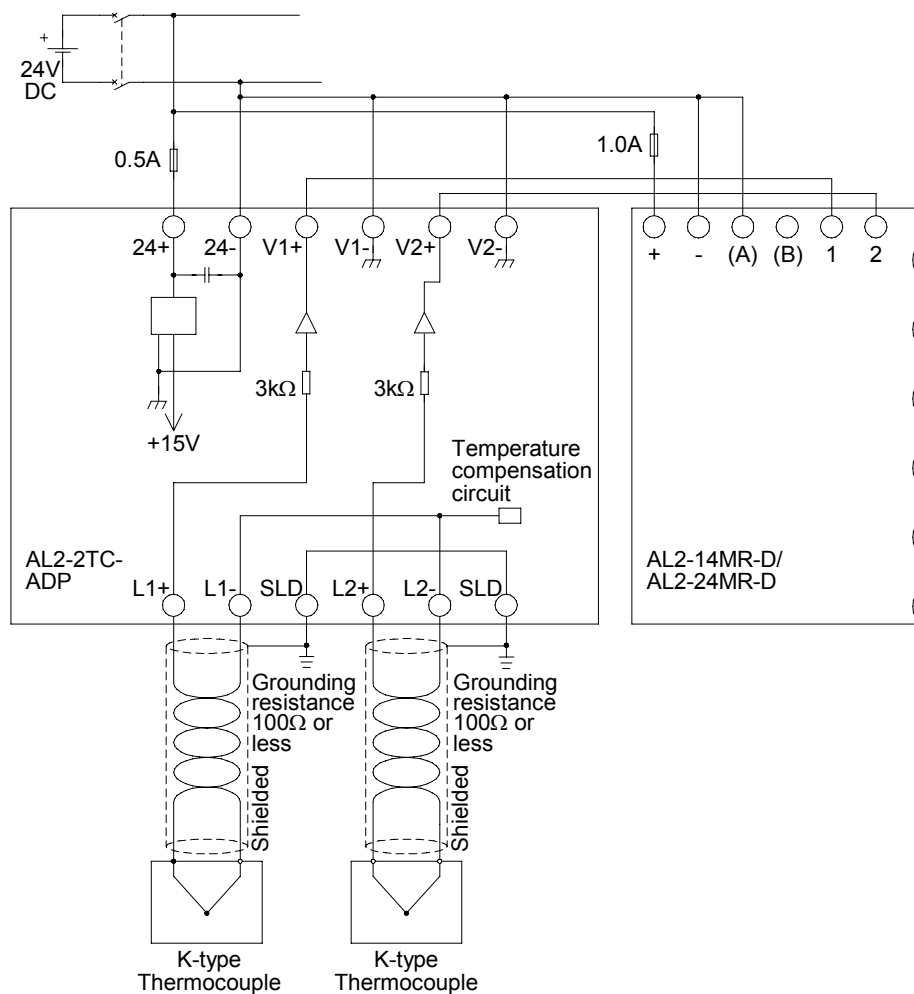


Caution

- Please use an isolated Power supply and turn off the Power before any wiring operation is performed.
- Input and Output cables should not be run through the same multi core cable or share the same wire.
- Input cable (from sensor to AL2-2TC-ADP) must be less than 10m (32'81") and the output cable length must be less than 3m (9'10").
- The wire should be used as a single cable or the multi core wires (can be used with a crimp terminal) should be carefully twisted together.
Do not connect a soldered wire end to the AL2-2TC-ADP.
- To avoid damaging the wire, tighten to a torque of 0.5 - 0.6 N·m.
- The AL2-2TC-ADP should be adjusted for offset and gain purposes, therefore, turn off the Power before performing the adjustment wiring.

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Figure 13.4:



13.4.3 Choosing a Temperature Scale

- 1) Turn on the power to the α 2 controller and select “Others...” from the TopMenu.

```
TopMenu
ClockSet
LANGUAGE
»Others...
```

- 2) Select “Analog In” from the Others... menu.

```
Others...
Serial Com
Light Time
»Analog In
```

- 3) Select “Temp. Scale” from the Analog In menu.

```
Analog In
I07
I08
»Temp. Scale
```

- 4) Choose “Celsius” or “Fahrenheit.” with the OK button.

```
Analog In
Temp. Scale
»Celsius
Fahrenheit
```



Only one system of units can be selected per controller.



The values under the Calibrate menu will remain in Celsius, regardless of the system of units that is selected for the controller, as they are the labels for the jumper pins on the Hardware.

13.4.4 Offset Adjustment



Note

If Gain adjustment is complete, then step 3 - 7 are not needed.

- 1) To begin the offset calibration for channel 1, turn off the power to the α2 controller and the AL2-2TC-ADP and remove the temperature sensor. The pins L1-, L1+ and SLD should be left unconnected.
- 2) Remove the top cover from the jumper area and move the jumper to the pins labeled -50°C as in “Hardware Setup” below.



Caution

The jumper should be installed correctly, otherwise, on occasion electrical contact may not occur.

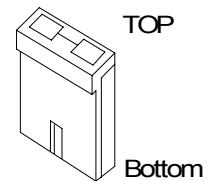
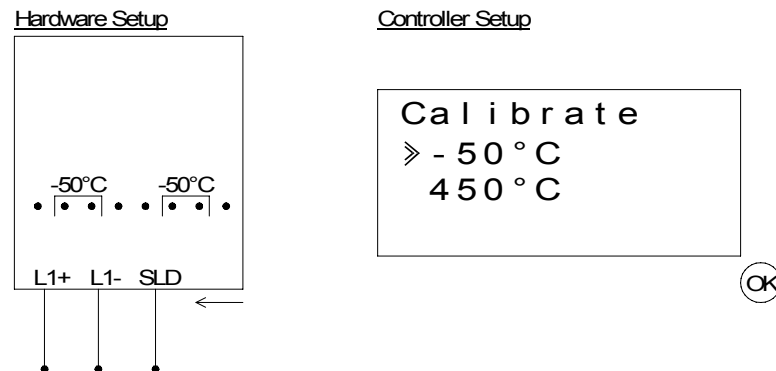
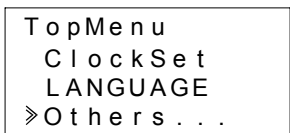


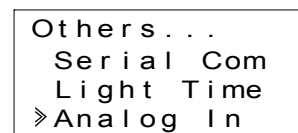
Figure 13.5: AL2-2TC-ADP Offset Adjustment



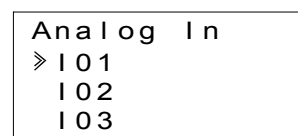
- 3) Turn the power on and select “Others...” from the TopMenu while in Stop Mode.



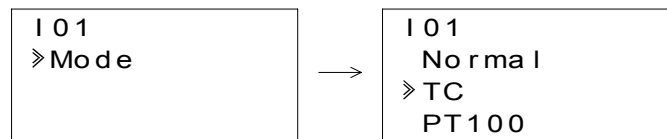
- 4) Select “Analog In” from the “Others...” menu.



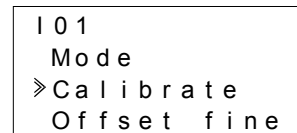
- 5) Select the Input that is connected to the AL2-2TC-ADP module.



- 6) Configure the input for temperature sensing with the AL2-2TC-ADP module by selecting “Mode” and choosing “TC” from the following screen



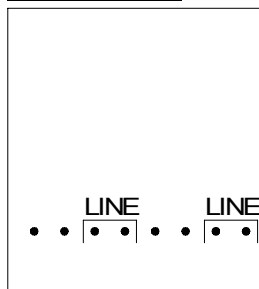
- 7) After setting the mode to “TC”, select “Calibrate” from the Analog input settings menu.



- 8) Select “-50°C” from the Calibrate menu as in “Controller Setup” in the figure 13.5 and press OK. There should be a confirmation message that reads “OK.” If not, refer to the Applicable Error Checks section below. This completes the offset calibration procedure. To calibrate the offset for channel 2, repeat the steps above replacing L1-, L1+ and SLD with L2-, L2+ and SLD respectively. When the calibration is finished, move the jumper to the “LINE” pins.

Figure 13.6: Jumper position after calibration

Hardware Setup



It is usually necessary to perform the Gain Adjustment when performing the Offset Adjustment. See section 13.4.5 for more details.

13.4.5 Gain Adjustment

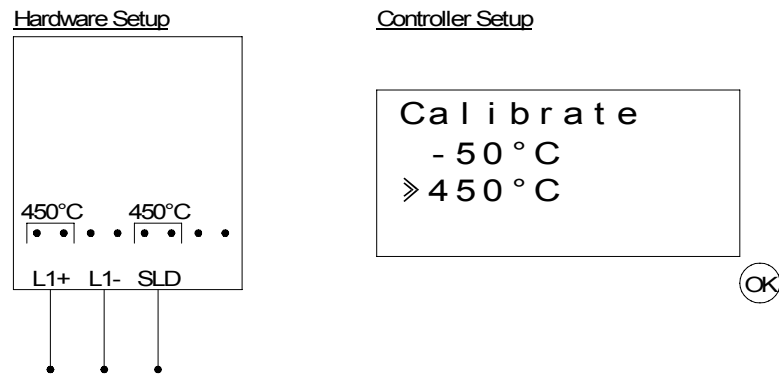
Note

If Offset adjustment is complete, then step 3 - 4 are not needed.

- 1) To begin the gain calibration for channel 1, turn off the power to the α 2 controller and the AL2-2TC-ADP and remove the temperature sensor. The pins L1-, L1+ and SLD should be left unconnected.

- 2) Remove the top cover from the jumper area and move the jumper to the pins labeled 450°C as in “Hardware Setup” below.

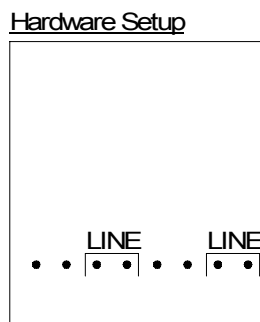
Figure 13.7: AL2-2TC-ADP Gain Adjustment



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- 3) Turn the power on and select “Others...” from the TopMenu while in Stop Mode.
- 4) After setting the mode to “TC” (See the Offset Adjustment description above.), select “Calibrate” from the Analog input settings menu.
- 5) Select “450°C” from the Calibrate menu as in “Controller Setup” in the figure above. There should be a confirmation message that reads “OK.” If not, refer to the Applicable Error Checks section below. This completes the gain calibration procedure. To calibrate the gain for channel 2, repeat the steps above replacing L1-, L1+ and SLD with L2-, L2+ and SLD respectively. When the calibration is finished, move the jumper to the “LINE” pins.

Figure 13.8: Jumper position after calibration



It is usually necessary to perform the Offset Adjustment when performing the Gain Adjustment. See section 13.4.4 for more details.

13.4.6 Fine Offset Adjust



The fine adjust should only be performed after both Gain and Offset Adjusts have been performed.

- 1) From the TopMenu, select “Others...”

```
TopMenu
ClockSet
LANGUAGE
»Others...
```

- 2) From the Others... menu, select “Analog In”

```
Others...
Serial Com
Light Time
»Analog In
```

- 3) From the Analog In menu select an input that is configured for TC input.

```
Analog In
I01
I02:PT100
»I03:TC
```

- 4) Select “Offset fine” from the Analog Input settings menu.

```
I03
Mode
Calibrate
»Offset fine
```

- 5) Using the + and - buttons, enter a value from -31°C to 31°C (-55.8°F to 55.8°F).
Press the OK button when finished.

```
I03
Offset fine
0°C
```


13.4.7 Applicable Error Checks

In the event that the input voltage is greater than 11 V or equal to 0V the following system flags will be set.

Table 13.8:

		AL2-10MR-D	AL2-14MR-D AL2-24MR-D
M17	0: Normal 1: Defect at I01	✓	✓
M18	0: Normal 1: Defect at I02	✓	✓
M19	0: Normal 1: Defect at I03	✓	✓
M20	0: Normal 1: Defect at I04	✓	✓
M21	0: Normal 1: Defect at I05	✓	✓
M22	0: Normal 1: Defect at I06	✓	✓
M23	0: Normal 1: Defect at I07	—	✓
M24	0: Normal 1: Defect at I08	—	✓

- If the flags in the table above are activated, check that:

- a sensor is connected
- there is not a break in the sensor connection
- the temperature is not greater than the specified limit
- power is being supplied to the AL2-2TC-ADP.

- If the “Error” message appears instead of “OK” while offset/gain calibration, check that:

- The power is being supplied to the AL2-2TC-ADP.
- The AL2-2TC-ADP is connected to α 2 correctly.
- The input, which connects the AL2-2TC-ADP is selected for calibration.
- The AL2-2TC-ADP inputs are left unconnected.
- The jumpers on AL2-2TC-ADP is either placed on the “-50°C” position or the “450°C” position.
- The calibration menu entry related to the jumper position is selected (“-50°C” or “450°C”).

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14. Key, System Bit and Function Block Lists

14.1 Key Lists

The following table is the keys to use operation in the Menu and user program. Further information can be found in α 2 Programming Manual.

Table 14.1: Operation Key Lists

Key Name	Key Number	Description
OK	K01	Acceptance of data entry, menu options, program choices
ESC	K02	Cancel current operation, move to higher screen or menu
+	K03	Connect function blocks, move to higher numbered blocks, increment values
-	K04	Disconnect function blocks, move to lower numbered blocks, decrement values
▲	K05	Scroll to higher number numbered items (keys, FB, Inputs, Outputs, etc.)
▼	K06	Scroll to lower numbered items (keys, FB, Inputs, Outputs, etc.)
▶	K07	Move to the right on the LCD display, FB program or Jump command
◀	K08	Move to the left on the LCD display, FB program or Jump command

14.2 System Bit Lists

There is the system bit controlled by system and the control bit to control from user program.

14.2.1 System Bit Lists

Table 14.2: System Bit Lists

System Bit	Description	AL2-10MR-*	AL2-14MR- AL2-24MR-*
M01	Always "ON"	✓	✓
M02	Always "OFF"	✓	✓
M03	Alternate - 0.5 seconds "ON", 0.5 seconds "OFF"	✓	✓
M04	"ON" when Real Time Clock data error occurs	✓	✓
M05	"ON" when Summer time schedule is activated	✓	✓
M06	"ON" when communication Error of AS-interface occurs	—	✓
M07	"ON" when communication Error by AS-interface power failure occurs	—	✓
M08	ON when turn Stop mode turns to Run mode in the α 2 Series. The ON signal acts as a pulse output and then turns OFF.	✓	✓
M09	OFF when turn Stop mode turns to Run mode in the α 2 Series. The OFF signal acts as a pulse output and then turns ON.	✓	✓
M10	"ON" during DCF77 decoding.	✓	✓
M11	Pulses "ON" when DCF77 finishes decoding without an error.	✓	✓
M12	"ON" when CD (DCD) signal is turned ON (receiving CD signal from modem)	—	✓
M13	"ON" when it is possible to access the GSM network.	—	✓
M14	"ON" when the α 2 series is accessed via GSM.	—	✓
M15	"ON" when DCF77 decoding with an error.	✓	✓
M16	"ON" when external power for the AL2-2DA board is ON.	—	✓
M17	"ON" when there is a sensor defect at I01	✓	✓
M18	"ON" when there is a sensor defect at I02	✓	✓
M19	"ON" when there is a sensor defect at I03	✓	✓
M20	"ON" when there is a sensor defect at I04	✓	✓
M21	"ON" when there is a sensor defect at I05	✓	✓
M22	"ON" when there is a sensor defect at I06	✓	✓
M23	"ON" when there is a sensor defect at I07	—	✓
M24	"ON" when there is a sensor defect at I08	—	✓

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14.2.2 Control Bit Lists

Table 14.3: Control Bits

Control Bit	Description	AL2-10MR-*	AL2-14MR- AL2-24MR-*
N01	ON: Disconnected to AS-interface network OFF: Connect to AS-interface network	—	✓
N02*1	ON: The back light is "OFF" in LCD. OFF: The back light is controlled by the "Light Time" setting in Menu.	✓	✓
N03*1	ON: The back light is "ON" in LCD. OFF: The back light is controlled by the "Light Time" setting in Menu.	✓	✓
N04	ON: The user screen is controlled by the setting of "Display Manager" with AL-PCS/WIN-E. OFF: The user screen is controlled by user program.	✓	✓

*1 When both N02 and N03 are ON and hence the back light is "ON" because N03 is given the priority.

14.3 Function Block Lists

Further information for function blocks can be found in the α2 Series Programming Manual.

Table 14.4: Function Block Lists

Function Block		Memory Consumption (Byte)	Description	AL2-10MR-*	AL2-14MR- AL2-24MR-*
Name	Symbol				
AND	AND	19	Output ON when all Inputs are ON, Unused inputs considered ON	✓	✓
OR	OR	19	Output ON when at least one input ON, Unused inputs considered OFF	✓	✓
NOT	NOT	10	Inverts a signal; changes an OFF to an ON and vice versa	✓	✓
XOR	XOR	13	Exclusive OR; Output ON when only One of Two Inputs is ON	✓	✓
NAND	NAND	19	Not AND; Output OFF only when all Inputs ON, Unused inputs considered ON	✓	✓
NOR	NOR	19	Not OR; Output OFF when at least one Input is ON, Unused inputs considered OFF	✓	✓
Boolean	BL	*1	Logic equation using AND, OR, XOR, NOT	✓	✓
Set/Reset	SR	14	Latch a relay in SET or RESET position, give Set or Reset priority	✓	✓
Pulse	PL	10	Send a Pulse on the Rising, Falling, or both Edges	✓	✓
Alternate	AL	13	Output alternates turning ON or OFF with each input pulse	✓	✓
Delay	DL	19	Delay a signal on the Rising, Falling, or both Edges	✓	✓
One Shot	OS	17	Send a single pulse; Time or Input signal based, Reset pin available	✓	✓
Flicker	FL	19	Send a pulse train; ON/OFF times, repetitions, duration, or continuous operation	✓	✓
Time Switch	TS	*2	Use the RTC to turn output ON/OFF; Calendar or weekly schedule	✓	✓
Time Switch Maintenance	TSm	*2	Use the RTC to turn output ON/OFF; Calendar or weekly schedule The function block can be setup from the TopMenu "Parameter" via the front panel keys.	✓	✓
Counter	CN	16	Count upwards on pulses, can reset at a signal	✓	✓
Up/Down Counter	UD	22	Count upward or downward, Set a Preset Value for the Output to come ON	✓	✓
Compare	CP	17	Compare two values for <, >, =, <=, >=, <> (Analog, Direct Set, or FB values)	✓	✓
Offset Gain	OG	22	Manipulate Analog Values; $y = A/B \cdot x + C$; Set High and Low Limit Values	✓	✓

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Table 14.4: Function Block Lists

Function Block		Memory Consumption (Byte)	Description	AL2-10MR-*	AL2-14MR- AL2-24MR-*
Name	Symbol				
Display	DP	*3	Display User Screen (messages or data) on the LCD display	✓	✓
Zone Compare	ZC	20	Compare a value to a range of values (Analog, Direct Set, or FB values)	✓	✓
Schmitt trigger	ST	19	Turn an Input ON at the High Value and OFF at the Low Value (or vice versa)	✓	✓
Hour Meter	HM	19	Records the accumulated time a signal has been ON	✓	✓
Speed Detect	SPD	25	The signal input frequency (On/Off) is measured for a set length of time. The frequency is compared to a value range and the Output is turned ON/OFF according to the result.	✓	✓
Pulse Width Modulation	PWM	16	A continuous pulse train is output when this function block is driven. The characteristics of the pulse are defined as; Pulse duty (Direct set, Analog, FB values), cycle time.	✓	✓
Retentive Alternate	RAL	13	Output alternates turning ON or OFF with each input pulse. The last output status is kept when the power supply is cycled OFF and ON. However, last output status is lost when the α 2 series is placed in the Stop mode.	✓	✓
Addition	ADD	20	$y = A + B$	✓	✓
Subtraction	SUB	20	$y = A - B$	✓	✓
Multiplication	MUL	20	$y = A \times B$	✓	✓
Division	DIV	20	$A \div B = q, r$ (quotient and remainder)	✓	✓
Calculation	CAL	*4	Equation using +, -, \times , \div , % and the selected data.	✓	✓
Shift	SFT	19	Shift operation; When "SFT" signal is input, last "I" signal status is output. When using 8 bit shift operation, "Shift" function block should be continued 8 times.	✓	✓
GSM SMS	SMS	*5	The contents of an LCD screen is sent as an SMS message.	—	✓
Short Message Receiving	SMR	*7	Output change by Short Message	—	✓

Table 14.4: Function Block Lists

Function Block		Memory Consumption (Byte)	Description	AL2-10MR-*	AL2-14MR- AL2-24MR-*
Name	Symbol				
Short Message Receiving Maintenance	SMRm	*7	Output change by Short Message The function block can be setup from the TopMenu "Parameter" via the front panel keys.	—	✓
Call Detect	CD	30	Calling Line Identification Presentation (CLIP) Phone number detection	—	✓
Call Detect Maintenance	CDm	30	Calling Line Identification Presentation (CLIP) Phone number detection The function block can be setup from the TopMenu "Parameter" via the front panel keys.	—	✓
Random One Shot	ROS	19	The random length single pulse is output.	✓	✓
Delayed One Shot	DOS	20	After a delay time, send a single pulse	✓	✓
Delayed Alternate	DAL	16	After a delay time, output alternates turning ON or OFF with each input pulse	✓	✓
Retentive Set/Reset	RSR	14	Latch a relay in SET or RESET position, give Set or Reset priority. The last output status is kept when the power supply is cycled OFF and ON. However, last output status is lost when the α2 series is placed in the Stop mode.	✓	✓
Proportional Integral Gain	PID	52	The PID Function Block is the α2 implementation of PID, a control method used to obtain stable control over a system variable. It is equipped with an Auto-tuning function, which automatically adjusts the Function Block parameters for the specific application.	✓	✓
Analog Output	AO	17	The Analog Output function takes a digital value input and delivers a corresponding analog voltage or current to a selected channel on the AL2-2DA module.	✓	✓
Control Display	CDP	*6	Control which Display screen appears on the LCD. This function block can only be set in the AL-PCS/ WIN-E software. When control bit N04 is ON, it possible to control the displayed User Screen.	✓	✓

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Table 14.4: Function Block Lists

Function Block		Memory Consumption (Byte)	Description	AL2-10MR-*	AL2-14MR- AL2-24MR-*
Name	Symbol				
Connect	_B	10	This CONNECT function block is an internal FB used to show the memory used by the system bits, the bits for AS-interface, and the operation keys. No function block appears on screen or shows as being used in the "Memory Configuration Usage" dialog box, the purpose is only to calculate the memory that is used by the bits listed above.	✓	✓
System Outputs	Out	10	Control external device through relays and transistors.	✓	✓

*1 Number of bytes used = $19 + 1 \times (\text{Characters in equation})$

*2 Number of bytes used = $8 + 4 \times (\text{Number of time switches})$

*3 Number of bytes used is decided by the displayed item.

Table 14.5: Displayed Item and number of bytes used

Displayed Item		Number of bytes, α2 Series
Characters		$16 + 1 \times (\text{Each character displayed})$
Analog, FB value	Value	17
	Graph	23
Time, Date		14
Time Switch		17

*4 Number of bytes used = $30 + 1 \times (\text{Characters in equation})$

*5 Number of bytes used = $12 + 1 \times (\text{Characters in E-Mail address})$

*6 Number of bytes used = $32 + 3 \times (\text{Number of screen})$

*7 Number of bytes used = $37 + (\text{Number of characters of setup commands})$

15. Diagnostics



Caution

- Do not touch the terminal while energized. This might cause an equipment malfunction or an electric shock.



Caution

- Supply correctly rated power.
When a power supply different from the ratings is supplied, this product might be damaged or cause a fire.
- Connect “L (Live)” of the power supply to “L terminal” in the main unit, and connect “N (Neutral)” to “N terminal” in the main unit correctly when wiring the AC power supply. Faulty wiring will cause an electrical shock, damage to the controller, or a fire.
- Connect the “L (Live)” wire of the power supply to the input terminal of the AC unit.
- Connect the “+” of the power supply connect to the “+ terminal” in the main unit, and connect the “-” of the power supply to the “- terminal” when wiring the DC unit. Faulty wiring will cause an electrical shock, damage to the controller, or a fire.



Notes on use

- The α 2 Series controller must be used with either the memory cassette, communication cable, or connector cover installed. Otherwise, the exposed socket can cause damage to the controller or an electric shock to the operator.
- Use the expansion module or the connector cover while power is supplied to the α 2 series controller.
Improper equipment installation can cause damage to the controller or an electric shock.

ENG

15.1 Input Status Error

Place the α2 controller in the Stop mode. Cycle the power to the equipment connected to the input terminals and check if the input status is displayed correctly. If it is not correctly displayed, check the points below.

Further information about the status display can be found in the α2 Programming Manual.



Notes on use

Do not connect a wire with a soldered end to an α2 series terminal due to poor contact and the possibility of the wire shearing.

- 1) Check the wiring for the power supply and the inputs.
- 2) Check if the equipment used for the inputs corresponds to the specification in section 2.3 in this manual.

15.2 Output Status Error

Place the α2 controller in the Stop mode. Force the outputs ON/OFF and check the operation of the outputs. Check that the program is written to perform per the desired results.

Further information can be found about the force ON/OFF operation in the α2 Programming Manual.



Notes on use

Perform the forced ON/OFF operations only after thoroughly checking that it is safe to do so. Damage to the machine or controller or a safety issue could arise if the forced ON/OFF is performed inappropriately.

If proper precautions are not taken, damage to the equipment or machine failure may occur.

- 1) Check the wiring for the power supply and the outputs.
- 2) Check if the equipment used for the outputs corresponds to the specification in section 4.4 in this manual.

15.3 TOP MENU is not Displayed

The menu key should be operated to access the Top Menu. Push the keys “OK” and “ESC” at the same time. If the menu call key is not set, use either the programming software to the Stop mode or do the forced stop operation.

The Top Menu cannot be accessed from the keys. However, by cycling the power supply and pressing the “OK + ESC” keys simultaneously during the power up, the Top Menu will appear.



Caution

Perform the forced stop operation only after thoroughly checking that it is safe to do so. Damage to the machine or controller or a safety issue could arise if the forced ON/OFF is performed inappropriately. If proper precautions are not taken, damage to the equipment or machine failure may occur.

Forced Stop Operation

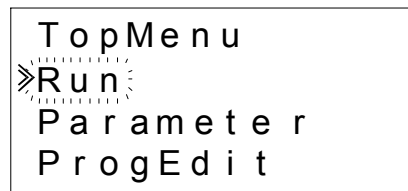
- 1) Turn the α2 series power supply off.
- 2) Turn the power ON again while pushing the “OK” and “ESC” keys simultaneously.

The screen at right is displayed.

The option to place the controller in Stop mode will be available for approximately five seconds. Press the “OK” key to enter the Stop Mode. If no key is pressed, the controller will default back into the Run mode.



- 3) Push “ESC” key.
The “Top Menu” shown at right is displayed.



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15.4 Cannot enter Run Mode.

When the α 2 series will not switch to Run mode, check the following.

- 1) The message "Input Error" or "Output Error" is displayed on the screen.
The program included in the memory cassette has more points of input and/or output than is allowed in the controller body.
 - a) When making the program with the programming software.
The content of the program and the model are checked with the programming software.
Write the program to the α 2 series controller and do not use a memory cassette.
 - b) When making the program with the α 2 series front panel keys.
Remove the memory cassette, and make the program again.
 - c) Install the memory cassette in the α 2 series of 24 point type.
 - d) Write the program in an α 2 series of the same type in which the program will be used.
- 2) The program data has an error.
When the program cannot be displayed with "ProgEdit" in "TopMenu", it is possible that the program data was damaged. Switch from "TopMenu" to the Run mode after deleting the program.
 - a) The program again and switch to Run mode.
 - b) Consult a Mitsubishi Distributor when unable to switch to the RUN mode.

15.5 Incorrect Clock Data

Confirm the following item.

- 1) The time data is lost.
When approximately 20 days or more (25°C.) have passed since power was supplied to the α 2 series, the time data is lost. In this case, the time data should be set.
Further information about setting the time data can be found in the α 2 Programming Manual.
- 2) There are keep advancement by the time data and keep a delay.
The accuracy of the time data is ± 5 seconds a day. Use the time correction function when the time data error increases.
Further information about setting the time correction function can be found in the α 2 Programming Manual.

15.6 The "?" appears on the Display

The "?" mark is displayed when an unacceptable key is pressed according to the screen data. Confirm the acceptable options and press the appropriate key.



15.7 Cannot Use an Operation Key

Check the movement of the operation keys according to the following procedures when the α2 series will not accept a key operation. If the steps outlined in instructions (1) - (5) below can be performed, the keys are operating properly. Please check if the key(s) are used in the program.

- 1) Place the controller in the Stop mode. Consult a Mitsubishi Distributor when the Stop mode cannot be entered.



Caution

Perform the forced stop operation only after thoroughly checking that it is safe to do so. Damage to the machine or controller or a safety issue could arise if the forced ON/OFF is performed inappropriately. If proper precautions are not taken, damage to the equipment or machine failure may occur.

Forced Stop Operation

- a) Turn the α2 series power supply off.
- b) Turn the power ON again while pushing the “OK” and “ESC” keys at same time.
The screen at right is displayed for 5 seconds.
The option to place the controller in Stop mode will be available for approximately five seconds. Press the “OK” key to enter the Stop Mode. If no key is pressed, the controller will default back into the Run mode.
- c) Push the “ESC” key.
The “Top Menu” shown at right is displayed.

```
Run
  → Stop
```

```
Top Menu
» Run
Parameter
ProgEdit
```

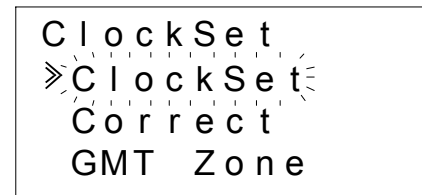
- 2) Scroll through the Top Menu with “▲” key or “▼” key.
Consult a Mitsubishi distributor when you cannot scroll.
- 3) Move the cursor to “ClockSet” with “▲” key or “▼” key, and push the “OK” key twice.
The “ClockSet” screen at right is displayed.
Consult a Mitsubishi distributor when it is not displayed.

```
ClockSet
mm / dd / yyyy
09 / 06 / 2001
13 : 55 Thu
```

- 4) Try to change the month/year data using the “◀” key, “▶” key, “+” key and “-” key.
Consult a Mitsubishi distributor when editing is not possible.

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- 5) Push the “ESC” key.
The screen at right is displayed and the operation of (4) is invalidated.
Consult a Mitsubishi Distributor when the correct screen is not displayed.



15.8 Incorrect LCD display

Check the following items.

- 1) The character is displayed in reverse and the entire screen is black.
Consult a Mitsubishi Distributor when the above error occurs. The α 2 controller display has been damaged.
- 2) An Unexpected Display Configuration is Shown
When the display does not appear as expected, please check the following points in the program.
 - a) Adjust the position where each display function begins. Two separate displays might have an overlapping display area that causes the undesired result.
 - b) The character fails to display
 - Check if the input pin to the Display Function Block is On.
 - Check whether there is a conflict with another display.

15.9 Memory Cassette Is Not Working Correctly

Check the following items when the memory cassette is not recognized or the cassette transfer functions are not functional.



Notes on use

- Use the memory cassette, the telecommunication cable, or the connector cover while power is supplied to the α 2 series controller.
Improper equipment installation can cause damage to the controller or an electric shock.
- 1) The memory cassette must be installed correctly, refer to section 6.1 for the proper installation procedure.
 - 2) The message “ProtectSW Error” is displayed.
The data protection (ProtectSW) is set.
Refer to the α 2 Programming Manual for the procedure to unlock this setting.
 - 3) The message “Password Error” is displayed.
The password is set. Try again after disabling the password.
Refer to the α 2 Programming Manual for the procedure to disable the password.

The “ProgClear” option can delete the password, program, and all Top Menu settings. The controller will return to the factory default settings.

Refer to α 2 Programming Manual for the procedure to use the “ProgClear” operation.

15.10 Cannot Communicate with the AS-interface Master Module

Check the following items.



Notes on use

- Use the expansion board or the connector cover while power is supplied to the α 2 series controller.
Improper equipment installation can cause damage to the controller or an electric shock.

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- 1) Check whether AS-interface power supply is adequate.
- 2) Check that the control bit N1 is Off. Use one of the two methods below to change its status if required.
 - a) When not using it in the program
Force the status to Off, refer to α 2 Programming Manual for the Force On/Off procedure
 - b) When using it by the program
Change the program or manipulate the inputs so that the control bit N1 turns Off.
- 3) Check that the slave address is correct.
Set the slave address from the AS-interface master module.
Refer to the manual of section 9.4.1 and the AS-interface master module for the address setting method.
 - a) Another slave's address and the AL2-ASI-BD's address overlap.
Set the address so that there is no conflict.
 - b) Slave address is 0.
Set a valid slave address from the AS-interface master module.
- 4) AL2-ASI-BD is not an active slave on the master module side.
Check the setting of the master module.
Refer to the manual of the AS-interface master module for the confirmation method.

15.11 Cannot Communicate with AL-PCS/WIN-E.

Check the following items.



Notes on use

Use the memory cassette and the communication cable or the connector cover while installed without fail.

It causes the electric shock and the breakdown.

- 1) Check cable (AL-232CAB) connection.
Refer to section 7.2 for the connection method.
- 2) Check the power supply supplied to the α 2 series.
Refer to section 4 for the wiring for the power supply.
Moreover, refer to section 2.2 for the specification of the power supply.
- 3) Check whether the COM port of the personal computer which has connected a setup and cable (AL-232CAB) of the "communication port" set up by programming software is in agreement. Match it when not matching. Match it.
- 4) When it is remotely maintained with a modem
 - a) Check whether a setup of the modem by the side of α 2 series is correct.
Refer to α 2 programming manual and section 7.3 for the setting of the modem connected to the α 2 series side.
 - b) Check the connection of cable made by customer.
For the connection of cable, refer to section 7.3.2.
 - c) Check the setting of the modem on the programming software side.
Check whether the disk for a setup of modem attachment is installed correctly.



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